

Hanford Site Solid Waste Acceptance Criteria

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management
Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

Fluor Hanford

P.O. Box 1000

Richland, Washington

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GLOSSARY

Acronyms

ALARA	as low as reasonably achievable	MSDS	material safety data sheet
ASTM	American Society for Testing of Materials	MW	mixed waste
CERCLA	<i>Comprehensive Environmental Response, Compensation and Liability Act of 1980</i>	NDA	nondestructive assay
CFR	Code of Federal Regulations	NDE	nondestructive examination
CIN	container identification number	NLF	nonuranium limit fraction
CSER	Criticality Safety Evaluation Report	NORM	naturally occurring radioactive material
CWC	Central Waste Complex	NPIC	no potential for internal contamination
DE-Ci	dose equivalent curie	NRC	U. S. Nuclear Regulatory Commission
DOE	U. S. Department of Energy	OSR	operational safety requirements
DOE-RL	U. S. Department of Energy, Richland Operations Office	PCB	polychlorinated biphenyls
DOT	U. S. Department of Transportation	PE-Ci	plutonium equivalent curie
DW	dangerous waste	PHMC	Project Hanford Management Contract
EHW	extremely hazardous waste	QA	quality assurance
EPA	U. S. Environmental Protection Agency	QAP	quality assurance program
FH	Fluor Hanford	QC	quality control
FGE	fissile gram equivalent	RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
GEA	gamma energy analysis	RMA	radioactive material area
HDPE	high-density polyethylene	SWB	standard waste box
HEPA	high-efficiency particulate air	TRU	transuranic
HIC	high-integrity container	TRUPACT	transuranic package transporter
HNF	Hanford Nuclear Facility (document identifier)	TSCA	<i>Toxic Substances Control Act of 1976</i>
ISB	interim safety basis	TSD	treatment, storage, and/or disposal
LDR	land disposal restrictions	TSR	technical safety requirements
LLBG	Low-Level Burial Grounds	ULF	uranium limit fraction
LLD	lower limit of detection	WAC	Washington Administrative Code
LLW	low-level waste	WIPP	Waste Isolation Pilot Plant
MBA	material balance area	WMP	Waste Management Project
MCM	minimum critical mass	WRAP	Waste Receiving and Processing Facility
		WSRd	waste specification record

DEFINITIONS

Acceptable knowledge. Characterization information collected by a generator to meet waste management requirements and determined to be adequate by the TSD unit.

Asbestos-containing waste material. Mill tailings or any waste that contains commercial asbestos and is generated by a source subject to 40 CFR 61 Subpart M. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and waste materials contaminated with asbestos including disposable equipment and clothing. (40 CFR 61.141)

Bulk waste. Waste that is not containerized for disposal and contains potentially dispersible radiological contamination, such as soil and rubble.

Byproduct material. (1) Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. (DOE M 435.1-1)

Chelating agent. Amine polycarboxylic acids (e.g., EDTA, DPTA), hydroxy-carboxylic acids, and polycarboxylic acids (e.g., citric acid, carboic acid, and glucinic acid). (10 CFR 61.2)

Class IV oxidizer. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. In addition, the oxidizer will enhance the burning rate and could cause spontaneous ignition of combustibles. Examples include ammonium perchlorate, ammonium permanganate, guanidine nitrate, hydrogen peroxide solutions greater than 91%, and tetranitromethane (UFC 1994).

Combustible waste. Any waste that does not meet the definition of non-combustible waste.

Contact handled. Packaged waste whose external surface dose rate does not exceed 200 milirem per hour, except that packages larger than 208 liters (55 gallons) could have a marked point on the bottom or side with a surface dose rate up to 1,000 millirem per hour.

Container. Any portable device in which a material is stored, transported, treated, disposed, or otherwise handled. (WAC 173-303-040)

Corrosive material. (Class 8) means a liquid or solid that causes full thickness destruction of human skin at the site of contact within a specified period of time. A liquid that has a severe corrosion rate on steel or aluminum based on the criteria in 49 CFR 173.137(c)(2) is also a corrosive material. (49 CFR 173.136)

Corrosive waste. A dangerous waste that exhibits the characteristic of corrosivity defined in WAC 173-303-090(6).

Dangerous waste. Solid waste designated in WAC 173-303-070 through -100 as dangerous or extremely hazardous waste, or mixed waste. (WAC 173-303-040)

Dangerous waste constituents. Dangerous waste constituents are those constituents listed in WAC 173-303-9905 and any other constituents that have caused a waste to be a dangerous waste under WAC 173-303.

Decontamination. The removal of radioactive material from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Department of Energy, Richland Operations Office (DOE-RL). The field element of the U.S. Department of Energy that operates the Hanford Site.

Disposal facility. The land, structures, and equipment comprising a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

Dose-equivalent curie. A method of normalizing the radiotoxicity of various radionuclides to plutonium-239 for use in establishing that operations remain within approved safety bases at certain Hanford Site waste management units. The normalization is based on the relative committed effective dose equivalent from inhalation of each radionuclide to that of plutonium-239 using the conversion factors from Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion".

EPA hazardous waste numbers. The number assigned by the EPA to each hazardous waste listed in 40 CFR 261, Subpart D, and to each characteristic identified in 40 CFR 261, Subpart C.

Explosive waste. A waste that meets the definition of WAC 173-303-090 (7)(a)(vi), (vii) or (viii).

Extremely hazardous waste. Extremely hazardous waste means dangerous waste and mixed waste designated in WAC 173-303-100 as extremely hazardous. (WAC 173-303-040)

Facility. All contiguous land, structures, other appurtenances, and improvements on the land, used for recycling, reusing, reclaiming, transferring, treating, storing, or disposing of dangerous waste. The Hanford facility consists of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of these). (WAC 173-303-040)

Fissile material. Material made up of nuclides that will sustain a chain reaction by thermal (slow) neutron induced fission. For the Hanford Site criticality safety program, uranium-233, uranium-235, plutonium-239, and plutonium-241 are the primary nuclides of interest. In addition, plutonium-238 is considered fissile material for transportation under 49 CFR 173.

Fissionable materials. Substances containing nuclides capable of sustaining a nuclear fission chain reaction (regardless of neutron energy). Such material could be fissionable only by nature of its form, configuration or environment. This includes, but is not limited to, uranium-233, uranium-235, plutonium-238, plutonium-239, plutonium-240, plutonium-241, neptunium-237, americium-241, and curium-244.

Flammable liquid. A liquid having a flash point of not more than 60.5° C (141° F), or any material in a liquid phase with a flash point at or above 37.8° C (100° F) that is intentionally heated and offered for transportation at or above its flash point in a bulk packaging. (49 CFR 173)

Flammable solid. Any of the following types of materials: wetted explosives, self-reactive materials that are liable to undergo a strongly exothermal decomposition caused by excessively high temperatures or contamination, or readily combustible solids that might cause a fire through friction. (49 CFR 173)

Free liquids. Free liquids are those liquids determined to be present in a waste as defined by the *Paint Filter Liquids Test, Method 9095 of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846).

Generator. Any person, by site, whose act or process produces radioactive or mixed waste or whose act first causes a waste to become subject to regulation under WAC 173-303. The term generator also includes any person or organization that manages a dangerous waste at the generating site on behalf of the generator.

Gross weight. The tare weight of a container plus the weight of its contents.

Hanford Site Treatment, Storage, and/or Disposal Unit or Hanford Site TSD Unit. Any one of the operational treatment, storage, or disposal units having acceptance criteria defined by this document. This specifically excludes all other TSD units identified on the Hanford Site.

Hazardous waste. Solid waste designated by 40 CFR 261 and regulated as a hazardous waste and/or mixed waste by the EPA.

High-level waste. High level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. (DOE M 435.1-1)

Ignitable waste. A dangerous waste that exhibits the characteristic of ignitability as described in WAC 173-303-090(5).

Incompatible waste. Incompatible waste means a dangerous waste that is unsuitable for placement in a particular device or facility because it might corrode or decay the containment materials or is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, fumes, mists, or gases, or flammable fumes or gases. (WAC 173-303-040)

Infectious waste. Any waste that contains or is suspected to contain pathogenic microorganisms infectious to humans, including: cultures and stocks of infectious agents, human blood and body fluids, contaminated animal carcasses, body parts, bedding exposed to infectious agents, and human pathological waste. Waste that has been treated by heat (e.g., incineration, autoclaving) or chemical disinfectants to destroy pathogenic organisms is not considered infectious waste.

Inner liner. A continuous layer of material placed inside a tank or container that protects the construction materials of the tank or container from the contained waste or reagents used to treat the waste. (WAC 173-303-040)

Lab pack. A packaging method where a number of inner containers of waste are packaged into an outer drum as specified in 49 CFR 173.12(b). For this document, the term also could be used for U.S. Department of Transportation (DOT) Class 7 materials packaged in the same manner.

Land disposal restrictions. The restrictions and requirements for land disposal of hazardous or dangerous waste as specified in 40 CFR 268 and WAC 173-303-140. (Refer to definitions for RCRA Land Disposal Restrictions and Washington State Land Disposal Restrictions.)

Low-level mixed waste. Waste that meets both the definition of low-level waste and mixed waste.

Low-level waste. Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material. (DOE M 435.1-1)

Mixed waste. 'Mixed waste' means a dangerous, extremely hazardous, or acutely hazardous waste that contains both a nonradioactive hazardous component and, as defined by 10 CFR 20.1003, source, special nuclear, or by-product material subject to the *Atomic Energy Act of 1954* (42 U.S.C. 2011 et seq.). (WAC 173-303-040)

Major radionuclides. Those radionuclides in a waste that contribute significantly to the overall hazards of the waste, including criticality and human exposure by various pathways, as the waste is managed.

Mobile radionuclides. Radionuclides that tend to migrate readily through Hanford soil and pose the highest risk of impact to groundwater resources: tritium (hydrogen-3), carbon-14, chlorine-36, selenium-79, molybdenum-93, technecium-99, iodine-129, rhenium-187, uranium (all isotopes), and neptunium-237.

Non-biodegradable sorbent. A sorbent material meeting the requirements of 40 CFR 264.314(e).

Noncombustible waste. Containerized waste that show no evidence of combustion or decomposition on exposure to 538° C (1,000° F) for 10 minutes as specified by NUREG-0782, or waste that has been stabilized by grouting or disposal in a HIC.

Organic peroxide. Any organic compound containing oxygen (O) in the bivalent -O-O- structure and that might be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals.

Onsite. Onsite means any property within the Hanford Site boundary. (Note: U.S. DOT and RCRA regulations have varying definitions of onsite; the precise DOT and RCRA meanings of the term are not implied in the use of the term in this document.)

Operational safety requirements (OSR) or technical safety requirements (TSR). Those requirements that define the conditions, safe boundaries, and bases thereof and the management or administrative controls required to ensure the safe operation of a nuclear facility.

Organic liquid. A chemical compound having carbon-carbon chemical bonds and that is a liquid at standard temperature and pressure. Typical organic liquids include organic solvents, petroleum oils, and synthetic oils.

Outer packaging. The outermost enclosure of a composite or combination packaging together with any absorbent materials, cushioning, and any other components necessary to contain and protect inner receptacles or inner packagings. (49 CFR 171)

Packaging safety analysis. A formal risk assessment process to evaluate the suitability of a container or packaging system for transportation of radioactive materials. For transport of radioactive materials on the Hanford Site, a safety analysis report for packaging (SARP), safety evaluation for packaging (SEP), or documentation and analysis of packaging (DAP) is required. For offsite transportation, the safety requirements are defined in 49 CFR 173 and 10 CFR 71.

Performance assessment. An analysis of a radioactive waste disposal facility conducted to demonstrate there is a reasonable expectation that performance objectives established for the long-term protection of the public and the environment will not be exceeded following closure of the facility. (DOE M 435.1-1)

PHMC. Project Hanford Management Contract. The current contract with the U.S. Department of Energy to operate portions of the Hanford Site, including the facilities described in this document. Fluor Hanford (FH) is the PHMC contractor.

Plutonium-equivalent curie (PE-Ci). A method of normalizing the radiotoxicity in transuranic waste to plutonium-239 for use in establishing the approved safety limits at the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico. The normalization is based on the relative committed effective dose equivalent from inhalation of a radionuclide to that of plutonium-239 using the conversion factors from DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public", as described in Appendix B of DOE/WIPP-02-3122.

Plutonium-239 fissile gram equivalent (FGE). A method of normalizing fissile and fissionable isotopes to plutonium-239 for use in establishing criticality safety limits for the Hanford Site Solid Waste Program. This is consistent with the method found in the safety analysis reports for the TRUPACT-II and 72-B casks for plutonium-239, uranium-233, and uranium-235 and in ANSI/ANS 8.15 for other fissile, fissionable, and special actinide elements.

Polychlorinated biphenyl or PCB. Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contains such substance (40 CFR 761.3).

Process knowledge. Knowledge the generator applies to a solid waste to determine if it is a dangerous or mixed waste in light of the materials or the processes used, when such knowledge can be demonstrated to be sufficient for determining whether a solid waste is designated properly. Process knowledge includes information on waste obtained from existing published or documented waste analysis data or studies conducted on mixed waste from processes similar to that which generated the waste. Process knowledge for mixed waste also could include information obtained from surrogate material.

Pyrophoric material. A liquid or solid that, even in small quantities and without an external ignition source, can ignite within 5 minutes after coming in contact with air when tested as specified by 49 CFR 173.124.

Qualified analytical data. Data from waste analysis that are not fully compliant with an approved sampling and/or analysis method (e.g., where quality assurance/quality control deficiencies were identified from the sampling and/or analysis of the waste).

Radioactive waste. Any garbage, refuse, sludges, and other discarded material, including solid, liquid, semisolid, or contained gaseous material that must be managed for its radioactive content. (DOE M 435.1-1)

RCRA land disposal restrictions or RCRA LDR. The requirements and restrictions for land disposal of hazardous waste codified in 40 CFR 268.

Reactive waste. A dangerous waste that exhibits the characteristic of reactivity as described in WAC 173-303-090(7).

Remote handled. Packaged waste whose external surface dose rate exceeds the limits for contact-handled waste.

Remote-handled transuranic waste. Packaged transuranic waste whose unshielded external surface dose rate exceeds 200 millirem per hour. Test specimens of fissionable material irradiated for research and

development purposes only and not for the production of power or plutonium could be classified as remote-handled transuranic waste.

Secular equilibrium. Equilibrium that occurs between a parent radionuclide and daughter radionuclide where the half life of the parent is significantly longer than the daughter.

Shock-sensitive waste. Reactive waste meeting the definition of WAC 173-303-090(7)(a)(vii) (waste is readily capable of detonation or explosive composition or reaction at standard temperature and pressure).

Solidification. Any technique that reduces the solubility and mobility of dangerous waste constituents and/or radionuclides by physical means rather than by bonding or chemically reacting with the stabilizing material.

Sorb. To absorb or adsorb.

Sorbent. A material used to soak up free liquids by either adsorption or absorption, or both.

Specific activity. The radiological activity (disintegrations per unit of time) of a radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the radiological activity per unit mass of the material.

Spent nuclear fuel. Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. Test specimens of fissionable material irradiated for research and development only, and not production of power or plutonium, may be classified as waste, and managed in accordance with the requirements of DOE 435.1 when it is technically infeasible, cost prohibitive, or would increase worker exposure to separate the remaining test specimens from other contaminated material. (DOE M 435.1-1)

Spontaneously combustible material. A pyrophoric or self-heating material. (49 CFR 171)

Stabilization. Any technique that reduces the solubility and mobility of dangerous waste constituents and/or radionuclides by bonding or chemically reacting with the stabilizing material. The term stabilization to meet LDR is used when the specific definition of 40 CFR 268.42, Table 1, is implied.

Standard waste box (SWB). A payload container authorized for use with TRUPACT-II transportation packages for packaging of transuranic waste (NRC 1996).

State-only dangerous waste. Any waste that is regulated as a dangerous waste under WAC 173-303 but is not regulated as a hazardous waste under 40 CFR 261. (WAC 173-303-040)

Storage. The holding of radioactive waste for a temporary period, at the end of which the waste is treated, disposed of, or stored elsewhere. (DOE M 435.1-1).

Toxic. Having the properties to cause or to significantly contribute to death, injury, or illness of humans or wildlife. (WAC 173-303-040)

Toxic Substances Control Act PCB waste or TSCA PCB waste. Any PCB-containing waste that is regulated under the TSCA requirements codified in 40 CFR 761.

Transuranic mixed waste, or TRU-mixed waste. Waste that meets both the definitions of transuranic waste and mixed waste.

Transuranic waste. Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61 (DOE M 435.1-1).

Treatment. "Treatment" means the physical, chemical, or biological processing of dangerous waste to make such waste nondangerous or less dangerous, safer for transport, amenable for energy or material resource recovery, amenable for storage, or reduced in volume, with the exception of compacting, repackaging, and sorting as allowed under WAC 173-303-400(2) and 173-303-600(3). (WAC 173-303-040)

Treatment, storage, and/or disposal unit manager or TSD unit manager. The individual, or delegate, having responsibility for the operation of a given TSD unit within the limits of the TSD unit RCRA Permit, safety basis, performance assessment, and/or other environmental requirements.

TRUPACT. A transuranic package transporter.

Washington State Land Disposal Restrictions or Washington State LDR. The land disposal restrictions of WAC 173-303-140(4).

Washington State-Only Dangerous Waste. Refer to state-only dangerous waste.

Waste Specification Record, or WSRd. A document that identifies the anticipated treatment, storage, and/or disposal methods to be applied to a given class of waste managed at Hanford Site TSD units.

Waste stream. A waste or group of wastes from a process or a facility with similar physical, chemical, or radiological properties. (DOE M 435.1-1)

Water-reactive waste. Waste that meets the definition of WAC 173-303-090(7)(a)(ii), (iii) or (iv).

WMP. Waste Management Project.

WMP acceptance organization. The organization within WMP that is responsible for waste acceptance, including approval of waste stream profiles and approval of individual waste packages and shipments, and for coordinating the approval of case-by-case evaluations for specific criteria and exceptions to the acceptance criteria.

1.0 INTRODUCTION

DOE Order 435.1 requires that each treatment, storage, and/or disposal facility (referred to in this document as TSD unit) that manages low-level or transuranic (TRU) waste (including mixed waste and TSCA PCB waste) maintain waste acceptance criteria. These criteria must address the various requirements to operate the TSD unit in compliance with applicable safety and environmental requirements.

1.1 PURPOSE AND SCOPE

This document sets forth the baseline criteria for acceptance of waste at TSD units operated by WMP. The criteria for each TSD unit have been established to ensure that waste accepted can be managed in a manner that is within the operating requirements of the unit, including environmental regulations, DOE Orders, permits, technical safety requirements, waste analysis plans, performance assessments, and other applicable requirements. Revisions to the acceptance criteria document require an Unreviewed Safety Question review to document that the changes are consistent with current applicable safety analysis.

Acceptance criteria apply to the following TSD units: the Low-Level Burial Grounds (LLBG) including both the nonregulated portions of the LLBG and trenches 31 and 34 of the 218-W-5 Burial Ground for mixed waste disposal; Central Waste Complex (CWC); Waste Receiving and Processing (WRAP) Facility; and T-Plant facility. Waste from all generators, both from the Hanford Site and from offsite facilities, must comply with these criteria. Exceptions can be granted as provided in Section 1.6.

Specific waste streams could have additional requirements based on the identified TSD pathway. These requirements are communicated in the waste specification records (WSRds) and/or waste stream profile sheet approvals.

The Hanford Site manages nonradioactive waste through direct shipments to offsite contractors. The waste acceptance requirements of the offsite TSD facility must be met for these nonradioactive wastes. This document does not address the acceptance requirements of these offsite facilities.

Selection of specific storage locations and internal container movement inside a TSD unit is outside the scope of this acceptance criteria.

1.2 ROADMAP TO THE WASTE ACCEPTANCE CRITERIA

This chapter describes general administrative requirements applicable to generators, along with introductory information.

Chapter 2.0 identifies requirements that generally are applicable to waste sent to any of the TSD units. These criteria relate primarily to overall characterization and segregation methods used by generators.

Chapters 3.0 through 7.0 communicate the unit-based criteria for acceptance of waste. Each of these chapters contains a general description of the unit functions followed by identification of prohibited waste, physical/chemical acceptance criteria, radiological acceptance criteria, and packaging criteria. These TSD units and the general functions are as follows.

- Chapter 3.0: The unlined portion of the Low-level Burial Grounds is for disposal of low-level radioactive waste not regulated as hazardous waste, dangerous waste, or TSCA PCB disposal prohibited waste.
- Chapter 4.0: The lined portion (trenches 31 and 34) of the 218-W-5 Burial Ground is a RCRA-permitted disposal unit for certain mixed waste that meets federal and state LDR requirements. The unit may also dispose of certain types of TSCA PCB waste.
- Chapter 5.0: CWC is a storage unit for low-level mixed waste, low-level TSCA PCB waste, TRU waste, TRU mixed waste, TRU TSCA PCB waste, and other waste types that must be stored pending treatment and/or disposal.
- Chapter 6.0: T-Plant facility is a multipurpose unit for storage, repackaging, treatment, and decontamination of radioactive waste. T-Plant facility can accept low-level and TRU waste, including mixed and TSCA PCB waste.
- Chapter 7.0: WRAP is a multipurpose unit for processing and treatment of low-level and TRU waste, including mixed and TSCA PCB waste. WRAP can perform nondestructive assay (NDA) and nondestructive examination (NDE) of waste containers. WRAP is the primary unit for repackaging and processing of TRU waste for certification for disposal at WIPP.
- Chapter 8.0 lists references used throughout the document.
- Appendix A provides radiological calculation methods.
- Appendix B provides fissionable material content limits.
- Appendix C describes labeling of containers.
- Appendix D describes selection of containers.
- Appendix E describes selection of sorbents.
- Appendix F describes Hanford Site radiological release of waste.
- Appendix G provides TRU waste acceptance criteria.

1.3 WASTE ACCEPTANCE PROCESS

All non-Hanford Site waste generators must receive approval from DOE-RL before acceptance and shipment of waste to Hanford Site TSD units.

The process for obtaining approval to ship waste to the Hanford Site TSD units is described on the *Hanford Site Solid Waste Acceptance Program* Internet web site (<http://www.hanford.gov/wastemgt/wac/index.htm>). Use of the waste acceptance process is mandatory.

1.4 GENERATOR RESPONSIBILITIES

Generators of radioactive waste have certain general responsibilities under DOE Order 435.1. Acceptance of waste at Hanford Site TSD units is contingent on effective implementation of these responsibilities.

1.4.1 Waste Certification Program

Generators must implement and maintain a waste certification program to ensure that any waste sent to a Hanford Site TSD unit meets the acceptance criteria of that unit (DOE M435.1-1, Sections III.J. and IV.J.). Generators are responsible financially for costs incurred by Hanford Site TSD units as a result of nonconformance with the acceptance criteria. All non-conforming containers can be returned to the generator for resolution. There is no obligation for WMP TSD units to correct generator nonconformances.

1.4.2 Quality Assurance Program (QAP)

Each generator shall have a QAP as part of their overall waste certification program. The QAP shall implement the requirements of 10 CFR 830, Subpart A, Quality Assurance Requirements and DOE Order 414.1A (DOE M435.1-1). The generator QAP shall be subject to evaluation in accordance with the requirements of Section 1.5.

1.4.3 Waste Minimization Program

Generators shall establish and maintain an auditable waste minimization program, including goals, incentives, procedures, and reports, to ensure that the amount of radioactive waste generated and/or shipped for disposal is minimized (DOE M435.1-1). For Hanford Site generators, the *Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan* (DOE/RL-91-31) defines the methods for meeting this requirement.

1.4.4 Waste Forecast

Generators that wish to ship waste to Hanford Site TSD units shall provide an annual waste forecast. The timing and format of the waste forecast will be provided by WMP.

1.5 EVALUATION OF GENERATOR WASTE CERTIFICATION PROGRAM

Under DOE M 435.1-1, receiving TSD units must evaluate waste to ensure the waste meets the acceptance criteria of the unit. This requirement is implemented through review of information submitted by the generator and verification and confirmation inspections performed on waste containers. When repeated or serious nonconformances are found, additional evaluations will be performed as defined in the waste analysis plan for that TSD unit. When necessary, an onsite audit of the waste certification program of the generator, including applicable portions of the QAP, will be required.

1.6 EXCEPTIONS TO THE WASTE ACCEPTANCE CRITERIA

Exceptions to these acceptance criteria may be granted in certain cases. The process to obtain approval of an exception is determined by the source and type of the requirements from which the specific acceptance

criterion is derived. These requirements fall into three categories, each having a specific approval process, as described in the following sections.

A generator can request an exception from one or more of the criteria in this document. The request should be in writing to the WMP acceptance organization. The request must identify the specific requirement(s) in this document for which an exception is desired, the reason an exception is needed, and any proposed alternative methods to meet the general intent of the requirement.

WMP will review the exception request and determine the appropriate category and approval process, based on the background documentation for these acceptance criteria. This documentation identifies the source(s) of each requirement so a determination can be made whether an exception could be approved by WMP, or whether DOE-RL and/or regulatory agency approvals are required. On completion of this review, the WMP acceptance organization will respond in writing, identifying whether the exception is granted, rejected, or requires further evaluation or clarification.

1.6.1 WMP-Approved Exceptions

An exception can be granted to these acceptance criteria when the WMP acceptance organization demonstrates that the exception does not affect compliance with (1) any applicable regulations and (2) any DOE-RL and/or regulatory agency-approved requirements documents. For example, a TSD unit's container size limits are operational requirements not related to any regulation or externally-approved document. If a larger container could be managed at that TSD unit with special handling provisions, WMP can grant an exception to the container size requirement.

The WMP acceptance organization, in conjunction with the TSD operations organization, documents and certifies that the exception being granted does not affect compliance with any applicable regulations or any of the externally-approved requirement documents of the TSD units.

1.6.2 DOE-Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with a DOE-approved requirement documents (e.g., safety basis, performance assessment) or DOE Orders will require a DOE-RL waiver, DOE-RL approval of a safety document revision, or other DOE-RL approval. For this type of exception, the appropriate waiver request, document revision, or other applicable request for approval will be submitted by WMP, in coordination with FH to DOE-RL.

1.6.3 Regulatory Agency-Approved Exceptions

Exceptions to acceptance criteria that could affect compliance with regulations, permit conditions, compliance orders, or other requirements imposed by a regulatory agency must be submitted by DOE-RL to the affected regulatory agency(s).

1.7 PRECEDENCE OF REQUIREMENTS

Cases might arise where two or more similar requirements or limits occur in the acceptance criteria. All requirements and limits must be met. If it appears that one requirement or limit is less restrictive than others, the more restrictive one must be met.

2.0 GENERAL REQUIREMENTS

Certain general requirements apply to acceptance of all waste at Hanford Site TSD units. These requirements are described as follows.

2.1 GENERAL RADIOACTIVE CLASSES OF WASTE MANAGED AT HANFORD SITE TSD UNITS

The TSD units covered by these acceptance criteria manage low-level and TRU waste. This generally excludes acceptance of waste classified as high-level waste, spent nuclear fuel, and/or byproduct material.

2.2 COMPOSITION OF WASTE AND CONTAINERS

For all waste, a detailed record must be kept of the contents, volume, and weight, as well as any added void fillers, sorbents, stabilization agents, or solidification agents (DOE M435.1-1).

For containerized waste, the container type, weight, internal and external volume, any shielding provided, and the date packaged must be recorded (DOE M435.1-1). In the case of labpacks, the record should include the exact number, type, and volume of inner containers.

2.3 PHYSICAL AND CHEMICAL CHARACTERIZATION

The waste generator must determine the physical and chemical characteristics of the waste with sufficient accuracy and detail to properly designate and manage the waste in accordance with the unit-specific acceptance criteria and all applicable regulations (i.e., acceptable knowledge) (HNF-5841, WHC-SD-EN-WAP-005, HNF-1886, HNF-2165, 40 CFR 264.13, WAC 173-303-300, 40 CFR 761).

The following sections describe the physical/chemical characterization requirements for waste acceptance.

2.3.1 Types of Acceptable Knowledge

Types of information that can be used for physical/chemical characterization include data from analysis of the waste and knowledge of the materials and/or processes used to generate the waste. Acceptable knowledge requirements can be met using one or more of the following:

- Mass balance from a controlled process that has a specified output for a specified input
- Material Safety Data Sheet (MSDS) on unused chemical products
- Analytical data on the waste or a waste from a similar process
- Test data from a surrogate sample.

In addition, acceptable knowledge requirements can be met using a combination of analytical data or screening results and one or more of the following:

- Interview information
- Logbooks
- Procurement records
- Qualified analytical data
- Radiation work packages
- Procedures and/or methods
- Process flow charts
- Inventory sheets
- Vendor information
- Mass balance from an uncontrolled process (e.g., spill cleanup)
- Mass balance from a process with variable inputs and outputs (e.g., washing/cleaning methods).

If the information is sufficient to quantify constituents of regulatory concern and determine waste characteristics, as required by the regulations and unit-specific acceptance criteria, the information is considered acceptable knowledge.

2.3.2 General Waste Knowledge Requirements

The minimum level of acceptable knowledge must include designation data where the constituents causing a waste number to be assigned are quantified, and data that address any TSD unit-specific acceptance criteria necessary for proper management of the waste.

Analytical data and/or knowledge of the waste must be sufficient to determine whether the waste is regulated under 40 CFR 261, or 40 CFR 761, and/or WAC 173-303, and to assign correct waste numbers. Where the available information does not qualify as acceptable knowledge or is not sufficient to characterize a waste for management, sampling and testing methods outlined in WAC 173-303-110 must be used for toxic characteristics, corrosivity, and free liquids. For other characteristic and state criteria designations, when testing is needed, an appropriate method must be used. Appropriate test methods can include SW-846 test methods or any other methods with proper quality assurance (QA) and quality control (QC) standards.

In cases where constituents that could cause a waste to be regulated are input into a process, but are not expected to be in the waste in concentrations causing the waste to be regulated, sampling and analysis must be performed to demonstrate that the constituents are below regulated limits. This requirement can be met through chemical screening. This sampling and analysis is required only for initial characterization of the waste stream.

All waste must be characterized in a manner sufficient to ensure that the waste can be managed in accordance with the unit-specific waste management requirements set forth in this document. This includes (but is not limited to) sufficient knowledge to demonstrate that the waste is not prohibited from management at that unit, to segregate waste containers for compatibility, to ensure compatibility of waste with containers, to ensure that the waste can be safely managed, and to segregate waste for treatment, storage and/or disposal in accordance with the WSRds.

2.3.3 Land Disposal Restrictions Waste Knowledge

For waste that is a hazardous waste as defined in 40 CFR 261, waste characterization must be sufficient to establish whether the waste is a restricted waste under the LDR provisions of 40 CFR 268 and, if so, to determine the applicable treatment standard(s) for that waste. Testing of a representative sample at a

Hanford Site laboratory or another independent laboratory is required if a generator certifies that a waste stream meets a concentration-based treatment standard of 40 CFR 268.

In addition, for waste that is a dangerous waste as defined in WAC 173-303, characterization must be sufficient to establish which, if any, of the Washington State LDR requirements of WAC 173-303-140 are applicable.

2.3.4 Exceptions to Physical and Chemical Characterization Requirements

The following exceptions can be made to the physical/chemical characterization requirements stated previously.

- Hazardous debris that is managed in accordance with the alternative treatment standards for hazardous debris (40 CFR 268.45) does not require sampling and analysis for adequate physical/chemical characterization.
- Hanford Site generators can transfer waste for storage at an onsite TSD unit without full characterization for designation and LDR status, provided that: (1) characterization is sufficient to demonstrate that the waste can be managed in accordance with the unit-specific acceptance criteria and (2) a representative sample (or samples) has been obtained or will be obtained at the TSD unit to fully characterize the waste.
- An alternative management path negotiated through DOE-RL with the appropriate regulatory agency can characterize waste that cannot be characterized in accordance with the requirements stated previously because of factors such as unique chemical or radiological hazards of the waste. This type of exception will be handled by the method outlined in Section 1.6.3.

2.3.5 Recertification

Physical/chemical characterization data for a waste stream must be recertified annually, and whenever the waste generating process changes. Recertification shall, at a minimum, identify changes to the generating process and any additional analytical data obtained from the waste stream. This does not require sampling and analysis of the waste stream more frequently than required by the regulations.

2.4 RADIOLOGICAL CHARACTERIZATION

The major radionuclides in the waste and the concentration of each major radionuclide must be established with sufficient sensitivity and accuracy to properly classify and manage the waste in accordance with the TSD unit-specific radiological limits (DOE M 435.1-1).

2.4.1 Identification of Major Radionuclides

For the purposes of the radiological criteria in this document, major radionuclides are defined as those radionuclides that meet any of the following conditions. Calculational methods for determining these limits are described in Appendix A.

- Any TRU radionuclide present in the waste in concentration exceeding 1 nanocurie per gram.

- Any fissionable radionuclide present in the waste in a quantity exceeding 0.1 FGE per container.
- Any radionuclide present in concentration exceeding 1 percent of its respective Category 1 limit (Appendix A, Table A-2. Note: this reporting limit does not apply to TRU waste).
- Any radionuclide that is reportable on shipping papers in accordance with 49 CFR 173.433
- Any mobile radionuclide present in concentration that exceeds its reporting limit (Appendix A, Table A-2. Note: this reporting limit does not apply to TRU waste).
- For waste that has no detectable radiological activity but cannot be radiologically released, major radionuclides are those radionuclides believed to contribute more than 1 percent each of the radiological activity based on available process knowledge. The estimated concentration of the radionuclides should be based on the limit of detection of the analysis method used.
- The amount of Uranium-235 and Uranium-238 must be reported in each waste that contains at least 0.1 grams of Uranium-235, or if either is a major radionuclide. The amount of Uranium-233 must also be reported in each waste if 0.1 grams or greater.
- Any radionuclide that accounts for more than 1 percent of the total radiological activity of the waste. However, a radionuclide in concentration less than 1.0 E-6 Ci per cubic meter, and not otherwise reportable, is exempt from reporting.

2.4.2 Methods for Establishing Radionuclide Inventory

The radionuclide inventory of a waste must be established using a method or combination of methods capable of identifying and quantifying the major radionuclides present. The methods chosen must provide adequate sensitivity and accuracy to ensure that the waste is categorized correctly (e.g., Category 1 and 3 limits for the LLBG, correct TRU determination). A graded approach (DOE M 435.1-1) should be applied when planning radiological characterization of waste streams. Using the graded approach, more frequent and detailed analysis is performed when a waste approaches one or more of the limits of these criteria. Conversely, waste that is far below applicable limits of these criteria would not require as extensive or frequent analysis. Use of the data quality objectives process (or an equivalent process) in accordance with DOE M 435.1-1, should help ensure that the appropriate type, quantity, and quality of radiological characterization data are obtained.

Both direct and indirect methods can be used for characterization (DOE G 435.1-1). When indirect methods are used, these methods must be corroborated periodically with direct measurements. The frequency of corroborative analysis should be based on the variability of the waste generating process, and the extent and consistency of previous analytical data. A graded approach should be applied when determining the appropriate type and frequency of corroborative analysis.

The following characterization methods can be used individually or in combination to establish the radionuclide inventory of the waste.

- Process knowledge – Process knowledge includes documented knowledge of the radioactive materials used and the processes that contributed to the radiological content of the waste, along with historical analysis of waste and radiological contamination from the process. Process knowledge can be used to establish the suspected major radionuclides in a waste stream. In addition, process knowledge can be used to eliminate from further consideration those radionuclides not present in sufficient

concentration to be major radionuclides as defined in Section 2.4.1, as long as the basis of this determination is documented.

- Radionuclide material accountability - The content of a given radionuclide in a waste can be determined by documented logs detailing the mass or activity of that radionuclide added to and leaving the waste in a controlled process. In addition, data relating the total inventory of a radionuclide in a process or facility can be used to determine the radionuclide inventory, but must be corroborated periodically with direct measurement methods.
- Field and laboratory analysis methods - Field and laboratory analysis methods, such as NDA, radiochemical analysis, and surveys with field instruments, must be selected as appropriate to detect and quantify the major radionuclides with adequate sensitivity and accuracy for waste classification. Analysis methods that measure gross activity (i.e., not radionuclide specific) must be used in conjunction with other methods to determine the relative concentration (scaling factors) of each suspected radionuclide, and must be corroborated periodically with radionuclide-specific analysis.
- Computer modeling - Computer modeling, applied appropriately, could be used in conjunction with other methods for radiological characterization. An individual who is knowledgeable and experienced in the use and limitations of the model must perform the modeling. The assumptions and measurements used as inputs to computer modeling must be documented. The computer software must be controlled in a manner that meets conventional QA requirements. Computer models must be corroborated periodically with direct measurement methods.
- Scaling factors - Scaling factors can be used to relate the concentration of a readily-measured radionuclide to more difficult to measure radionuclides. Scaling factors must be developed from one of the previous methods, and must be corroborated periodically with radionuclide-specific analysis.

Other methods of radiological characterization could be used, but must be documented clearly and approved by the WMP acceptance organization. Documentation of the method must include a detailed description of the method, the radionuclides identifiable by the method, and a discussion of precision, accuracy, QA, and QC methods.

2.4.3 Additional Detail on Mobile Radionuclide Characterization

For low-level and low-level mixed waste, mobile radionuclide reporting is particularly critical for compliance with the LLBG performance assessments (WHC-EP-0645 and WHC-SD-WM-TI-730). Because of the low reporting limits and difficulty of analysis of certain mobile radionuclides, this section provides additional detail concerning acceptable knowledge and characterization.

The concentration of each mobile radionuclide must be established with respect to the Appendix A, Table A-2, reporting limit using process knowledge and/or analysis. If process knowledge alone is used to determine that a mobile radionuclide is not present in a waste stream at the reporting limit, the basis for this determination must be clearly documented. If available analysis techniques cannot detect a mobile radionuclide at its reporting limit, the concentration could be estimated using a combination of process knowledge, scaling factors, and analytical detection limits.

Mobile radionuclide reporting is intended to measure only the quantity of isotopes that exceeds Hanford Site natural background concentrations. For waste forms that contain uranium that originates from natural background on the Hanford Site, the background concentration of that radionuclide can be subtracted from the total concentration.

2.4.4 Recertification

The radiological characterization of waste streams must be recertified with sufficient frequency to account for changes in the generating process, radiological composition, and radiological decay.

2.4.5 Radioactive Material Shipments Less Than 70 Bq (0.002 uCi) Per Gram

- All shipments of radioactive materials having specific activities less than 70 Bq (0.002 uCi) per gram shall be shipped in a container that ensures no loss of the radioactive material during loading, inspections, transportation, and unloading.
- The shipping documentation shall have the following statement placed on it. "The following Container(s)_____ Contain Radioactive Material at concentrations that are not regulated for transportation per 49 CFR 173.403 but are not releasable per DOE Order 5400.5"
- A radiological survey report shall identify the package radiation exposure rates (i.e., contact and 30 cm readings), the expected radionuclides, associated activity levels and package contamination levels, including an evaluation of hard-to-detect radionuclides (e.g, H-3), when necessary. The radiological survey report shall be sent with the shipment as part of the shipping documents.

2.5 WASTE SEGREGATION AND TREATMENT AND/OR DISPOSAL PATH

The following sections discuss waste segregation and the treatment and/or disposal path.

2.5.1 Segregation of Uncontaminated Waste from Radioactive Waste

Generators shall segregate uncontaminated waste from radioactive waste to minimize waste volume and the cost of waste treatment and disposal (DOE M435.1-1).

2.5.2 Radiological Release of Mixed Waste

Generators shall attempt to obtain radiological release of dangerous waste and TSCA PCB waste generated from radioactive material areas in accordance with their site/facility radiological release criteria, unless one or more of the following conditions apply. (For Hanford PHMC generators, the site release criteria are provided in Appendix F.)

- Radiological contamination in the waste is measurable using field instruments.
- Process knowledge clearly identifies that radiological contamination was introduced into the waste.
- The analytical limit of detection for the waste matrix is above the site/facility radiological release limits (for Hanford Site PHMC subcontractor generators, the limits of Appendix F, Table F-2).
- The waste is treated and directly disposed as radioactive waste at a cost that is lower than the cost of radiological release and disposal as nonradioactive waste.

The basis for use of these conditions must be documented as part of the radiological characterization records for the waste.

2.5.3 Segregation for Treatment, Storage, and/or Disposal

All waste shall be segregated by the Waste Specification Records (WSRs) and waste stream profiles to facilitate proper treatment, storage, and/or disposal. The WSRs identify major waste streams, grouped in a manner that defines currently available storage and disposal methods and, for waste requiring treatment, the anticipated treatment and/or disposal methods. When it is not technically feasible or it is cost prohibitive to segregate a given waste stream by WSR and profile, the generator must document the basis for not segregating the waste. Acceptance of non-segregated waste is contingent on either (1) the WMP acceptance organization identifying a treatment/disposal pathway or (2) approval by DOE-RL to receive the waste stream for storage.

WSRs will include certain waste stream specific requirements to facilitate, treatment, storage, and/or disposal. These criteria must be met in addition to the requirements identified in this document.

The current set of WSRs along with instructions for selecting the appropriate WSR can be obtained from the *Hanford Site Solid Waste Acceptance Program* Internet web site (<http://www.hanford.gov/wastemgt/wac/index.htm>).

2.5.4 Waste Streams Having No Established Treatment/Disposal Path

Every effort shall be made to avoid the generation of waste for which no treatment/disposal path has been identified.

Written DOE-RL approval is required for acceptance of any waste stream that has no established treatment/disposal path.

2.6 MANAGEMENT AND CERTIFICATION OF NEWLY-GENERATED TRANSURANIC WASTE

Transuranic waste has a unique set of management and certification requirements based on the *Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, DOE/WIPP-02-3122. The Hanford Site meets these requirements through implementation of the *Hanford Site Transuranic Waste Certification Plan* (HNF-2600) and the *Hanford Site Transuranic Waste Characterization Quality Assurance Project Plan* (HNF-2599). Requirements applicable to generators of transuranic waste are identified in Appendix G.

2.7 RECORDS

The generator must retain all record copy material used for waste characterization and designation in accordance with federal and state requirements and DOE Orders. These records include process knowledge, sampling information, analytical data, inventory records, and related information. The generator must transfer copies of certain records as requested by the WMP acceptance organization through the waste acceptance process described on the *Hanford Site Solid Waste Acceptance Program* Internet web page (<http://www.hanford.gov/wastemgt/wac/index.htm>).

2.8 CLASSIFIED AND ACCOUNTABLE NUCLEAR MATERIAL

- Radioactive waste to which access has been limited for national security reasons and cannot be declassified shall be managed in accordance with the requirements of DOE 5632.1C, *Protection and Control of Safeguards and Security Interest*, and DOE 474.1, *Control and Accountability of Nuclear Materials*. (DOE M 435.1-1)
- The generator shall notify the WMP acceptance organization of any classified waste during the acceptance process. Classified waste is managed on a case-by-case basis.
- A DOE/NRC 741 form must be completed for waste that contains accountable nuclear material (DOE Order 474.1)

2.9 WASTE VERIFICATION

A portion of the waste containers sent to Hanford Site TSD units must be verified by physical inspection, nondestructive examination, and/or chemical screening as stated in waste analysis plans for the TSD units (e.g., HNF-1886). For most waste types, this verification can be performed at one of the Hanford Site TSD units. Certain types and configurations of waste, however, cannot be verified easily and could require verification at the generator's location before or during packaging. In these cases, generators must notify the Hanford Site acceptance organization and make verification arrangements before packaging the waste. This requirement applies to the following types of waste:

- Shielded waste
- Remote-handled waste
- Waste packaged in containers exceeding 3.05 meters long by 1.65 meters wide at bottom or 1.93 meters wide above 0.61 meters from bottom by 1.83 meters high (10 feet long by 5 feet 4 inches wide at bottom or 6 feet 4 inches wide above 2 feet from bottom by 6 feet high). These dimensions are absolute dimensions including any attachments such as lifting bails, lid flanges, etc.
- Waste containers weighing more than 3,180 kilograms (7,000 pounds)
- Mixed waste treated by macroencapsulation or microencapsulation
- Highly compacted (supercompacted) waste
- Waste packaged in plastic containers
- Other waste that is to be treated or packaged in a form that cannot be inspected easily subsequent to treatment or packaging

3.0 ACCEPTANCE CRITERIA FOR THE UNLINED PORTIONS OF THE LOW-LEVEL BURIAL GROUNDS

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements for the unlined portions of the LLBG. For criteria relating to the lined portions of the LLBG, refer to Chapter 4.0.

3.1 FACILITY DESCRIPTION AND FUNCTION

The LLBG are a land disposal unit for controlled burial of low-level radioactive waste. The LLBG includes a number of unlined disposal trenches that accept only radioactive waste not regulated under 40 CFR 261, WAC 173-303, and waste that is not excluded from disposal under 40 CFR 761 (TSCA PCB waste). The LLBG also include two disposal trenches (trenches 31 and 34) for disposal of mixed waste. This chapter relates only to the acceptance criteria for the unlined portions of LLBG. Acceptance criteria for trenches 31 and 34 are provided in Chapter 4.0.

3.2 PROHIBITED WASTE

The following types of waste are not disposed in the unlined portions of the LLBG:

- Waste that is dangerous or extremely hazardous as defined by WAC 173-303, or as hazardous waste as defined by 40 CFR 261
- TSCA-regulated PCB waste is prohibited except as specifically authorized under 40 CFR 761
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.1. Low-level waste must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical. (DOE M 435.1-1, Chapter IV, G.1.d.1) Additional requirements related to this criteria are listed in Section 3.5.6
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.2. Liquid low-level waste or low-level waste containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the low-level waste is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form. (DOE M 435.1-1, Chapter IV, G.1.d.2). Additional requirements related to this criteria are listed in Section 3.3.1.
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.3. Low-level waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable. (DOE M 435.1-1)
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.4. Low-level waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or

harmful to the long-term structural stability of the disposal site. (DOE M-435.1-1) Additional requirements related to this criteria are listed in Section 3.3.6.

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.5. Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20° C . (DOE M 435.1-1) Additional requirements related to this criteria are listed in Section 3.3.6.
- Unstabilized organic liquids (including sorbed organic liquids) exceeding 1% of the waste by weight
- Unstabilized chelating compounds exceeding 1% of the waste by weight
- Infectious waste
- Transuranic waste and waste that exceeds other radiological limits of Section 3.4.1
- Containers packaged such that toxic air pollutants exceed small quantity emission rates in WAC 173-460.

3.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical/chemical criteria for acceptance of waste at the LLBG.

3.3.1 Liquids and Liquid-Containing Waste

Liquids must be sorbed or stabilized in accordance with Appendix E.

3.3.2 Land Disposal Restrictions

Waste that is initially subject to regulation under RCRA can be disposed in Hanford's unlined LLW disposal units with a determination that the waste is no longer a dangerous waste, and that the waste meets the applicable treatment standards of 40 CFR 268 and WAC 173-303-140. These waste types normally include characteristic-only (D001-D043) waste and hazardous debris that exits RCRA regulation in accordance with 40 CFR 261.3(d) or (f).

For characteristic waste with concentration-based treatment standards, the generator/treater must obtain analytical data supporting the de-characterized waste determination, and the generator/treater must submit a notification and certification to their local EPA Region administrator and/or authorized State program (ref: 40 CFR 268.9(d)).

For debris that is excluded from the definition of hazardous waste, the generator/treater must submit a notification to their EPA Region administrator and/or authorized State program in accordance with 40 CFR 268.7(d)(1)), and the generator/treater must complete a certification in accordance with 40 CFR 268.7(d)(3).

Hanford may request that the generator/treater provide copies of these notifications and certifications with the submittal of waste profiles and/or waste shipment.

Waste initially designated as state-only waste under WAC 173-303 can be disposed in the LLBG with a determination that the waste has been properly treated and redesignated as nondangerous waste following treatment.

3.3.3 Solidification or Stabilization of Organic Liquids and Chelating Compounds

Organic liquids and chelating compounds exceeding 1 percent of the waste by weight must be solidified or stabilized to a form that immobilizes the organic and chelating compounds. Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

3.3.4 Asbestos-Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as it does not exceed applicable free liquid requirements.

3.3.5 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter (0.1 watt per cubic foot), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in the LLBG. This evaluation must be provided to and approved by the WMP acceptance organization.

3.3.6 Gas Generation

When low-level waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container. (DOE M 435.1-1, Chapter IV, L.1.b). Generators shall vent all containers exceeding 0.007 Watts/cubic meter or provide information demonstrating compliance with DOE M 435.1-1, Chapter IV, L.1.b. (RMIS Accession No. D8882672)

If required, the following mitigating measures (or alternative measures approved by the WMP acceptance organization) must be used:

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs could be used to control hydrogen concentrations in the container.
- Control of gases from biological decomposition: waste containing readily biodegradable organic materials (e.g., animal waste, vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition, slaked lime shall be added to the waste to reduce biological decomposition if filtering alone is not sufficient to control combustible gas concentrations.
- Packaging of animal carcasses: Radioactive animal carcasses must be packaged as follows.

™ Nucfil is a registered trademark of Nuclear Filter Technology Incorporated, 5161 Ward Rd., Wheat Ridge, CO 80033.

- The waste must be packaged in an inner and outer metal package, where the outer package has a capacity at least 40 percent greater than that of the inner package. The outer package must be a metal container that meets applicable transportation requirements for shipment to the LLBG.
- The inner package shall be lined with a minimum 4-mil plastic liner. The animal carcass(es) in the inner package must be surrounded with slaked lime. The plastic liner and inner package must be sealed.
- A minimum of 7.6 centimeters (3 inches) of mineral sorbent must be placed in the bottom of the outer package, the inner package placed into the outer package, and the void space filled between the two packages with additional mineral sorbent.
- The outer package must be sealed.

3.4 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste at the LLBG.

3.4.1 Radiological Concentration Limits

The methodology for classification of the radionuclide content of waste against the various limits listed in the following sections are provided in Appendix A. A waste must meet all of the following conditions to be disposed in the LLBG.

- TRU content limit - TRU content (as calculated by method A.1 of Appendix A) shall not exceed 100 nanocuries per gram of waste (DOE M 435.1-1)
- Waste category (as calculated by methods A.4 and A.5 of Appendix A) shall not exceed Category 3, except with an analysis coordinated by the WMP acceptance organization demonstrating that the LLBG Performance Assessment conditions are met (WHC-EP-0645, WHC-SD-WM-TI-730).
- Category 3 waste (as calculated by methods A.4 and A.5 of Appendix A) can be disposed of only if the waste meets one of the following waste form stability criteria (WHC-EP-0645, WHC-SD-WM-TI-730).
 - Packaging in a high integrity container (HIC) that is procured through the *Hanford High Integrity Container, 300 Year specification* (WHC-S-0486)
 - Packaging in a HIC approved by the WMP acceptance organization. (Note: a list of approved HICs is available on the *Hanford Site Solid Waste Acceptance Program* Internet web page (<http://www.hanford.gov/wastemgt/wac/index.htm>)
 - Placement in a monolith in the LLBG
 - Stabilization in concrete or other stabilization agents. The stabilized waste must meet the leach index and compression strength criteria of the *NRC Technical Position Paper on Waste Form*, Section C.2 and Appendix A (NRC 1991). Several Hanford approved concrete mix formulas have been developed that can be used to meet the stabilization criteria. Contact WMP Acceptance Organization for information on use of these formulas.

- Inherently stable waste that meets the stability requirements of 10 CFR 61.56 and the *NRC Technical Position Paper on Waste Form* (NRC 1991).
- Mobile radionuclides - If the concentration of any mobile radionuclide exceeds the Mobile Radionuclide Reporting Limit of Appendix A, Table A-2, stabilization could be required (WHC-EP-0645, WHC-SD-WM-TI-730). WMP will perform a case-by-case evaluation against the LLBG performance assessment (WHC-EP-0645, WHC-SD-WM-TI-730) to determine whether the waste requires stabilization to meet the groundwater pathway dose criteria. Stabilization normally would consist of placement of the waste container in a HIC, but additional stabilization might be required based on a number of factors such as waste form and radionuclide content. The WMP acceptance organization will coordinate this evaluation.
- ISB limits - Waste must meet the applicable ISB limits for the LLBG (as calculated by Section A.6 of Appendix A), with the following exception: if a combustible waste exceeds the combustible waste limit, but does not exceed the noncombustible waste limit, the WMP acceptance organization can coordinate an evaluation to determine whether segregation or stabilization can be used to mitigate the combustibility hazard (HNF-SD-WM-ISB-002).

3.4.2 Criticality Safety Limits

The limits for fissile and fissionable material are provided in Appendix B (CPS-SW-149-00003).

3.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of the *Project Hanford Radiological Control Manual* (HNF-5173), Table 2-2. For returnable overpacks, this criteria also applies to the outside of the inner package.

3.4.4 Package Dose Rate Limits

Containers with dose rates less than or equal to 200 millirem per hour at contact and less than 100 millirem per hour at 30 cm are acceptable at the LLBG. Contact handled containers (see definitions) exceeding these limits require container specific review and approval.

Remote handled waste is acceptable at LLBG if approved in both a waste stream profile sheet approval and a container specific shipment approval. Remote-handled waste shall meet the applicable dose rate restrictions of DOT or an approved packaging safety analysis. Remote-handled waste shall be configured for unloading such that personnel exposures are maintained as low as reasonably achievable (ALARA).

3.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at the LLBG.

3.5.1 Outer Packages

Outer packages that meet one of the following criteria will provide adequate containment for disposal.

- Packages that meet the applicable DOT requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

3.5.2 Package Construction

Containers must meet one of the following criteria to ensure compliance with the LLBG Fire Hazards Analysis:

- Constructed of metal, concrete, or masonry
- Constructed of wood that is either 1) pre-treated wood having the Underwriter Laboratories FR-S stamp, or 2) painted with a fire-retardant paint that has been approved by Underwriter's Laboratory or Factory Mutual
- Constructed of rigid plastic that has a maximum flame spread rating of 25 when tested by a nationally recognized testing laboratory to ASTM Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM E-84)
- Constructed of flexible plastic packaging provided the waste matrix is limited to soils, metals, concrete, or masonry. Incidental amounts of organic material such as personal protective equipment (PPE) are allowed in flexible packaging.
- Other containers as authorized under the LLBG Fire Hazards Analysis or as approved by WMP Fire Protection Engineering.

Sacrificial rigging shall not contain regulated materials, such as lead.

3.5.3 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, bulges, substantial corrosion, or other damage that could compromise integrity.

3.5.4 Securing Waste and Shielding

Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

3.5.5 Handling of Packages

All packages must be configured for safe unloading by forklift or crane. Alternate means of unloading could be allowed with approval from the TSD unit manager or designee. Packages that must be unloaded

by crane shall be equipped with a lifting system designed to safely lift the fully loaded package. All slings and lifting devices shall meet the requirements of the *Hanford Site Rigging Manual* (DOE-RL-92-36). For packages that have special unloading requirements, information must be provided to the WMP acceptance organization concerning the methods for unloading before the shipment is scheduled. Sacrificial rigging shall be provided for remote-handled waste packages. Rigging shall not contain regulated materials, such as lead.

3.5.6 Minimization of Subsidence

All waste shall be in a form that minimizes settling and subsidence of the LLBG to the maximum extent feasible (DOE M435.1-1, WHC-EP-0645, WHC-SD-WM-TI-730). The following forms will be considered to meet these criteria:

- Containerized waste that fills at least 90 percent of the internal volume of the outer container. Any void fillers must be selected and used in accordance with Appendix E
- Waste compacted to a minimum of 20 pounds per square inch, containerized soil and soil-like solids, and sorbed liquids, that fills at least 80 percent of the volume of the container
- Non-containerized waste that will not subside in the disposal environment (e.g., rocks, dirt, building rubble, activated metal)
- Packaging in a HIC or placement in a Hanford-provided HIC or monolith in the LLBG. If the applicable WSRd for the waste specifies that stabilization is required, this requirement will be met
- Stabilization in concrete or other stabilization agents per Section 3.4.1.

3.5.7 Labeling

Waste containers shall be labeled in accordance with Appendix C. Bulk waste and remote-handled waste containers that are removed from reusable overpacks are exempt from labeling requirements at the LLBG. For unusual waste forms, special labeling provisions can be arranged with the WMP acceptance organization.

3.5.8 Bulk (Noncontainerized) Waste

Certain types of waste can be disposed in bulk rather than packaging in containers. This includes soil, vegetation, building rubble, and other homogeneous waste having relatively low concentrations of radionuclides and hazardous chemical constituents. The *Solid Waste Burial Grounds Interim Safety Basis* (HNF-SD-WM-ISB-002) identifies the radiological and chemical conditions under which bulk waste may be disposed. To avoid unnecessary conservatism, universally applicable limits have not been developed for the LLBG acceptance criteria. Instead, a case-by-case evaluation will be performed on request to determine whether a given waste stream can be disposed in bulk, including any mitigating measures required to meet the conditions of the ISB.

Waste types that are not surface contaminated with readily dispersible radiological or hazardous chemical contamination, such as activated metal or internally contaminated equipment, may be considered containerized. As such, they are subject to the radionuclide and chemical concentration requirements for containerized waste rather than the bulk waste ISB requirements.

4.0 ACCEPTANCE CRITERIA FOR THE LINED PORTIONS OF THE LOW-LEVEL BURIAL GROUNDS

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements of the LLBG trenches 31 and 34.

4.1 FACILITY DESCRIPTION AND FUNCTION

Trenches 31 and 34 of the 218-W-5 Burial Ground are lined, RCRA-compliant units for disposal of certain low-level mixed waste. Currently, only low-level waste originally designated with RCRA characteristic numbers D001 through D043, certain listed waste numbers (F001 through F005, and F039 derived from F001 through F005 waste), and Washington state-only dangerous waste (except waste number WSC2) are accepted in trenches 31 and 34. All waste accepted at trenches 31 and 34 must meet the applicable LDR treatment standards of 40 CFR 268 and WAC 173-303-140. There also are safety-based and environmentally-based limits on the radionuclide concentrations of waste received.

4.2 PROHIBITED WASTE

The following types of waste are not disposed in trenches 31 and 34:

- Waste designated with any RCRA U, P, or K waste numbers, any F-listed waste other than F001, F002, F003, F004, F005, or F039, and WSC2 (DOE/RL-88-21). F039 waste is limited to waste derived from F001, F002, F003, F004, and/or F005 waste
- TSCA-regulated PCB waste except as specifically authorized by 40 CFR 761.
- Waste generated from CERCLA cleanup activities conducted, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.1. Low-level waste must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical. (DOE M 435.1-1, Chapter IV, G.1.d.1) Additional requirements related to this criteria are listed in Section 4.5.6
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.2. Liquid low-level waste or low-level waste containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the low-level waste is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form. (DOE M 435.1-1, Chapter IV, G.1.d.2). Additional requirements related to this criteria are listed in Section 4.3.1.
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.3. Low-level waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable. (DOE M 435.1-1)

- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.4. Low-level waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or harmful to the long-term structural stability of the disposal site. (DOE M-435.1-1) Additional requirements related to this criteria are listed in Section 4.3.7.
- Waste that does not comply with the requirement of DOE M 435.1-1, Chapter IV, G.1.d.5. Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20° C . (DOE M 435.1-1) Additional requirements related to this criteria are listed in Section 4.3.7.
- Waste that does not meet all applicable treatment standards of 40 CFR 268 and WAC 173-303-140
- Unstabilized chelating compounds exceeding 1 percent of the waste by weight
- Infectious waste
- Transuranic waste and waste that exceeds other radiological limits of Section 4.4.1
- Waste that poses substantial hazards because of formation of excessive heat generation from radiological decay (Section 4.3.6)
- Waste that is incompatible with the trench liner, as defined in Section 4.3.3 (40 CFR 264.301; WAC 173-303-665; HNF-5841)
- Containers packaged such that toxic air pollutants exceed small quantity emission rates in WAC 173-460.

4.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical/chemical criteria for acceptance of waste at trenches 31 and 34.

4.3.1 Liquids and Liquid-Containing Waste

All free liquids must be absorbed or stabilized in accordance with Appendix E, or otherwise removed from the waste, except as specifically allowed as follows.

- Containerized free liquids are allowed in the following situations, but cannot exceed 1 percent of the volume of the waste (40 CFR 264.314, HNF-5841):
 - Free liquids in a very small container, such as an ampule .
 - Small articles that contain free liquids required for the article to function (e.g., batteries or capacitors).
- For liquid-containing waste where condensate could form in inner plastic packaging (e.g., bags) subsequent to packaging, the condensate shall be eliminated to the maximum extent practical by placing sorbents within the inner plastic packaging (HNF-5841). The type and amount of sorbent required shall be in accordance with Appendix E. In any case, the amount of liquid may not exceed 1

percent of the volume of the waste or 0.5 percent of waste processed to a stable form (DOE M 435.1-1).

- Residual liquids in large debris items shall be sorbed or removed. In cases where it is not practical to remove suspected liquids and it is impossible to sample to determine if liquids are present, the liquids shall be removed to the maximum extent possible by draining suspected liquids at low points and placing an adequate amount of sorbent around each item (HNF-5841). In any case, the amount of liquid cannot exceed 1 percent of the volume of the waste (DOE M435.1-1).

4.3.2 Land Disposal Restrictions

All waste subject to RCRA LDR (40 CFR 268) and/or the Washington State LDR (WAC 173-303-140) must be demonstrated to meet all applicable treatment standards and requirements. For waste that has concentration-based treatment standards for specific hazardous constituents under 40 CFR 268, the waste must be tested at a Hanford Site laboratory or an other independent laboratory in accordance with 40 CFR 268. For waste that has treatment standards that are not concentration-based, the generator and/or treatment facility must demonstrate that the waste meets the applicable treatment standards using process knowledge and/or by waste analysis, as required by the applicable sections of 40 CFR 268 and WAC 173-303-140 (HNF-5841).

4.3.3 Compatibility of Waste With Liner

All waste disposed in trenches 31 and 34 must be compatible with the landfill liner system (HNF-5841). A variety of chemical constituents have been evaluated for compatibility with the liner system, and it is believed that waste that meets LDR requirements and the other acceptance criteria of this chapter will be compatible (HNF-5841, WHC-SD-WM-TI-714). An assessment will be performed by the WMP acceptance organization on each waste stream to confirm the compatibility of the waste with the liner. In cases where a waste contains constituents that have not been evaluated previously for liner compatibility, testing by *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Method 9090* (SW-846) could be required.

Note: Table 4-1 lists certain chemical constituents, in concentrated form, that have been evaluated and determined to be incompatible with the liner.

4.3.4 Solidification and Stabilization of Chelating Compounds

Chelating compounds exceeding 1 percent of the waste by weight must be solidified or stabilized to a form that immobilizes chelating compounds. Selection and use of solidification and stabilization agents shall be in accordance with Appendix E.

4.3.5 Asbestos-Containing Waste

Requirements are identical to those in Chapter 3.0, Section 3.3.4.

4.3.6 Heat Generation

The requirements are identical to those found in Chapter 3.0, Section 3.3.5.

4.3.7 Gas Generation

The requirements are identical to those found in Chapter 3.0, Section 3.3.6.

4.4 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste in trenches 31 and 34.

4.4.1 Radiological Concentration Limits

The requirements are identical to those found in Chapter 3.0, Section 3.4.1.

4.4.2 Criticality Safety Limits

The fissile and fissionable material limits are provided in Appendix B. Note that for Trenches 31 and 34, non-exempt quantities of uranium bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation (refer to Footnote 1 of Table B-3 in Appendix B) (HNF-SD-WM-SARR-028).

4.4.3 Package External Contamination Limits

The requirements are identical to those found in Chapter 3.0, Section 3.4.3.

4.4.4 Package Dose Rate Limits

The requirements are identical to those found in Chapter 3.0, Section 3.4.4.

4.5 PACKAGING CRITERIA

The following are packaging criteria for acceptance in trenches 31 and 34.

4.5.1 Outer Packages

Metal drums and HICs are acceptable for disposal in trenches 31 and 34. Other containers must be evaluated by the LLBG Engineering organization for structural stability and containment on a case-by-case basis. Outer packages that meet one of the following criteria will provide adequate containment for disposal.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

4.5.2 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, bulges, substantial corrosion, or other damage that could compromise integrity.

4.5.3 Package Construction

Containers must meet one of the following criteria to ensure compliance with the LLBG Fire Hazards Analysis:

- Constructed of metal, concrete, or masonry
- Constructed of wood that is either 1) pre-treated wood having the Underwriter Laboratories FR-S stamp, or 2) painted with a fire-retardant paint that has been approved by Underwriter's Laboratory or Factory Mutual
- Constructed of rigid plastic that has a maximum flame spread rating of 25 when tested by a nationally recognized testing laboratory to ASTM Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM E-84)
- Constructed of flexible plastic packaging provided the waste matrix is limited to soils, metals, concrete, or masonry. Incidental amounts of organic material such as PPE are allowed in flexible packaging.
- Other containers authorized under the LLBG Fire Hazards Analysis or as approved by WMP Fire Protection Engineering.

Sacrificial rigging shall not contain regulated materials, such as lead.

Containers shall be compatible with the waste and maintain containment during handling and storage before disposal. Where required, an appropriate combination of protective coatings and liners shall be used to prevent loss of container integrity.

4.5.4 Securing Waste and Shielding

Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

4.5.5 Handling of Packages

Handling requirements are the same as shown in Chapter 3.0, Section 3.5.5.

4.5.6 Minimization of Subsidence

All waste shall be packaged in a form that minimizes settling and subsidence in trenches 31 and 34 to the maximum extent feasible. (DOE M 435.1-1, WHC-EP-0645, WHC-SD-WM-TI-730) Containerized waste must be at least 90 percent full when placed in the disposal unit. (WAC 173-303-665).

4.5.7 Labeling

Waste containers shall be labeled in accordance with Appendix C. Bulk waste and remote-handled waste containers that are removed from reusable overpacks are exempt from labeling requirements at trenches 31 and 34.

4.5.8 Bulk (Noncontainerized) Waste

Bulk waste requirements are the same as shown in Chapter 3.0, Section 3.5.8.

Table 4-1. Chemical Constituents Known to be Incompatible With Liner System.

Chemical Constituent	Chemical Abstract Service Number(s)
Aqua regia	8007-56-5
Bromic acid	7789-31-3
Bromine (elemental)	7726-95-6
Bromobenzene	108-86-1
Bromoform	75-25-2
Calcium bisulfite	13780-03-5
Calcium sulfide	20548-54-3
Chlorine (elemental)	7782-50-5
1-Chloropentane (amyl chloride)	543-59-9
1,1-Dichloroethylene (vinylidene chloride)	75-35-4
1,2-Dichloropropane (propylene dichloride)	78-87-5
Diethyl benzene	105-05-5, 135-01-3, 141-93-5
Diethyl ether	60-29-7
Chloroethane (ethyl chloride)	75-00-3
Fluorine (elemental)	7782-41-4
Nitrobenzene	98-95-3
Sulfur trioxide	7446-11-9
Sulfuric acid, fuming	8014-95-7
Tetrachloroethylene	127-18-4
Thionyl chloride	7719-09-7
Trichloroethylene	79-01-6, 52037-46-4

Source: WHC-SD-WM-TI-714.

5.0 ACCEPTANCE CRITERIA FOR THE CENTRAL WASTE COMPLEX

The following criteria define baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements of CWC.

5.1 FACILITY DESCRIPTION AND FUNCTION

The CWC is a storage unit for low-level mixed, TRU, TRU mixed, TSCA PCB waste, and other waste types requiring treatment before disposal. Waste stored at CWC will be treated and repackaged as required for disposal as treatment capabilities become available.

The CWC manages waste having characteristic waste numbers D001 through D043, certain listed discarded chemical product waste numbers (U- and P- listed waste), certain F-listed waste (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste numbers. In addition, the CWC manages TSCA PCB waste from Hanford Site generators in accordance with 40 CFR 761. The CWC also can store waste from CERCLA cleanup activities.

5.2 PROHIBITED WASTE

The following waste types are not accepted for storage at the CWC:

- Waste having dangerous waste numbers other than those listed on the approved CWC Part A, Form 3, permit application (DOE-RL-88-21).
- Explosive waste (HNF-1886)
- Shock sensitive waste (HNF-1886)
- Pyrophoric waste (HNF-1886)
- Class IV oxidizer (see definitions) waste (HNF-1886)
- Waste that is readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable. (DOE M 435.1-1, Chapters III and IV, N.1)
- Containers packaged such that toxic air pollutants exceed small quantity emission rates in WAC 173-460
- Waste that exceeds any of the radiological limits of Section 5.4
- Liquid waste, except if packaged in labpacks or overpacks in quantities less than or equal to 57 liters (15gallons) per outer container
- Infectious waste.

5.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical criteria for acceptance of waste at the CWC.

5.3.1 Chemical Compatibility

All waste placed in a given outer container shall be chemically compatible (WAC 173-303-630).

5.3.2 Liquids and Liquid-Containing Waste

Sorption of liquids is allowed, but must be compatible with the treatment methods anticipated for disposal. Appendix E and the applicable WSRd specify the appropriate sorbents to be used for various waste streams.

For waste that could form condensate during storage, sufficient sorbent shall be added to the container to sorb any condensate formed.

5.3.3 Asbestos Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as the liquid does not exceed applicable free liquid requirements.

5.3.4 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter (0.1 watt per cubic foot), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers in storage. This evaluation must be provided to and approved by the WMP acceptance organization.

5.3.5 Gas Generation

- Vents or other mechanisms to prevent pressurization of containers or generation of flammable or explosive concentrations of gases shall be installed on containers of newly-generated transuranic waste at the time the waste is packaged. (DOE M 435.1-1, Chapter III, L.1.b.)
- When low-level waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container. (DOE M 435.1-1, Chapter IV, L.1.b). Generators shall vent all containers exceeding 0.007 Watts/cubic meter or provide information demonstrating compliance with DOE M 435.1-1, Chapter IV, L.1.b. (RMIS Accession No. D8882672)

If required, the following mitigating measures (or alternative measures approved by the WMP acceptance organization) must be used:

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.

- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, slaked lime could be required for waste that is expected to decompose rapidly.

5.4 RADIOLOGICAL CRITERIA

The following are the radiological criteria for acceptance of waste at the CWC.

5.4.1 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B (CPS-SW-149-00002).

5.4.2 Container Dose-Equivalent Curie Limits

Up to 35 DE-Ci per container are acceptable at the CWC as a routine shipment. Quantities up to 150 DE-Ci per container can be accepted, but must be evaluated to ensure compliance with facility inventory limits. (HNF-SD-WM-ISB-007).

5.4.3 Waste Exceeding Category 3

Waste having radionuclide concentrations exceeding Category 3 (except TRU waste) requires DOE-RL approval for acceptance.

5.4.4 Package Removable Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of the HNF-5173, Table 2-2. Use of fixatives is not allowed to meet the criteria. For returnable overpacks, the contamination limits and fixative prohibition also applies to the outside of the inner package.

5.4.5 Package Dose Rate Limits

Waste packages shall not exceed 1 milliSievert per hour (100 millirem per hour) at 30 centimeters (1 foot) from the waste package and 2 milliSieverts per hour (200 millirem per hour) at any point on the surface of the package.

5.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at the CWC.

5.5.1 Container Selection

The packages for stored waste shall meet applicable 49 CFR container requirements for the hazard class/division of the waste, except that packaging for onsite transfers under an approved packaging safety analysis might be allowed where cost or technical constraints make the use of a DOT-compliant package

unfeasible. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.

Outer containers shall be constructed of noncombustible materials. Wood, fiberboard, and plastic outer containers are prohibited (HNF-SD-WM-ISB-007).

5.5.2 Protective Coatings and Liners

The packaging for stored waste shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste, as follows.

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.
- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WMP acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

5.5.3 Packaging of Liquid Waste

The following are requirements for packaging of liquid waste as lab packs and overpacked liquids.

- Up to 57 liters (15 gallons) of liquid can be packaged in inner glass, metal, or plastic containers. Glass containers shall not exceed 4 liters (1.1 gallon) capacity each. Sufficient head space must be left in the inner containers to prevent breakage because of expansion in temperatures up to 55° C (131° F) and freezing conditions.
- Inner containers shall be securely closed. The lids of glass containers shall be sealed with Teflon™ or equivalent lid seals (gaskets). After closure, glass lids should be taped.
- All inner containers shall be compatible with the waste contents over the anticipated storage life of the waste.
- Each inner container shall be labeled with its contents.
- A sufficient quantity of polymer sorbent (selected in accordance with Appendix E) shall be packaged around the inner containers to sorb twice the volume of the liquid in the inner containers. The sorbent shall be placed around the inner containers in a manner that prevents shifting and breakage.

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5.5.4 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, dents, bulges, pit or scale corrosion, or other damage that could compromise container integrity (WAC 173-303-630). Minor external surface rust that can be sanded or brushed off will be acceptable. Containers having some pit or scale corrosion could be acceptable for storage provided the integrity of the container is confirmed by NDE.

5.5.5 Securing Waste and Shielding

Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation. Externally attached shielding is prohibited.

5.5.6 Package Size and Weight Limits

The following are the baseline size limits for CWC storage modules. Larger containers could be accepted into specific storage modules with special loading procedures. Drums smaller than 55 gallons are not accepted on a routine basis but could be approved on a case-by-case evaluation.

Table 5-1. Central Waste Complex Container Size and Floor Loading Limits.

Storage units	Package size limit	Floor loading limit
Alkali metal modules	320 liter (85 gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
Low-flashpoint modules	320 liter (85 gallon) drum	1,225 kilograms per square meter (250 pounds per square foot)
2401-W Building	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	2,200 kilograms per square meter (450 pounds per square foot)
2402-W Building	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	3,430 kilograms per square meter (700 pounds per square foot)
2402-WB through WL Buildings, 2403-W and 2404-W facilities	3.0 meters high by 3.4 meters wide (10 feet high by 11 feet wide)	9,800 kilograms per square meter (2,000 pounds per square foot)

5.5.7 Stacking

Packages must be designed to withstand the weight of two layers of 208-liter (55-gallon) drums weighing 454 kilograms (1,000 pounds) each stacked on top.

5.5.8 Labeling

Packages shall be labeled according to instructions contained in Appendix C.

6.0 ACCEPTANCE CRITERIA FOR THE T-PLANT FACILITY

This chapter defines the baseline requirements to comply with the regulatory, permitting, safety, environmental, and operational requirements at T-Plant facility.

6.1 FACILITY DESCRIPTION AND FUNCTION

T-Plant facility is a treatment and storage unit having a number of functions, including equipment decontamination, waste treatment, storage, sampling, NDE, repackaging, etc. The 221-T Building is being prepared for the storage of K-Basin sludge. In addition, this building also can be used for decontamination, treatment, and storage of equipment and waste. The 2706-T Building is used for the decontamination, treatment, storage, etc., of equipment and waste having relatively low levels of radiological contamination. The 214-T Building is for storage purposes.

Waste that can be managed at the T-Plant facility includes TRU, TRU-mixed, LLW, hazardous/dangerous low-level mixed, and TSCA PCB waste. The T Plant Complex Part A, Form 3, permit application includes characteristic waste numbers D001 through D043, all listed discarded chemical product waste numbers (U- and P- listed waste), F-listed waste having waste numbers F001 through F012, F019 through F023, F026 through F028, and F039, and all Washington State-only waste numbers (DOE/RL-88-21). The T-Plant facility also can manage TSCA PCB (40 CFR 761) waste.

Waste managed at the T-Plant facility could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these units must be met subsequent to processing at the T-Plant facility.

6.2 PROHIBITED WASTE

The following waste types are not accepted at the T-Plant facility:

- Waste having dangerous waste numbers other than those listed on the T Plant Complex Part A, Form 3, permit application. The prohibited waste numbers are F013 through F018, F024, F025, F032 through F038, and all K waste numbers (DOE-RL-88-21)
- Waste generated from CERCLA cleanup activities, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Explosive waste
- Shock sensitive waste
- Pyrophoric waste
- Class IV oxidizer (see definitions) waste
- Waste that is readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable. (DOE M 435.1-1, Chapters III and IV, N.1)

- Containers packaged such that toxic air pollutants exceed small quantity emission rates in WAC 173-460
- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20° C (68° F), except that pressurized aerosol cans can be accepted
- Waste that exceeds any of the radiological limits of Section 6.4
- Infectious waste.

6.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical acceptance criteria for T-Plant facility.

6.3.1 Chemical Compatibility

All waste placed in a given outer container shall be chemically compatible (WAC 173-303-630).

6.3.2 Asbestos-Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as the liquid does not exceed applicable free liquid requirements.

6.3.3 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter (0.1 watt per cubic foot), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers. This evaluation must be provided to and approved by the WMP acceptance organization.

6.3.4 Gas Generation

- Vents or other mechanisms to prevent pressurization of containers or generation of flammable or explosive concentrations of gases shall be installed on containers of newly-generated transuranic waste at the time the waste is packaged. (DOE M 435.1-1, Chapter III, L.1.b.)
- When low-level waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container. (DOE M 435.1-1, Chapter IV, L.1.b). Generators shall vent all containers exceeding 0.007 Watts/cubic meter or provide information demonstrating compliance with DOE M 435.1-1, Chapter IV, L.1.b. (RMIS Accession No. D8882672)

If required, the following mitigating measures (or alternative measures approved by the WMP acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.
- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, slaked lime could be required for waste that is expected to decompose rapidly.

6.4 RADIOLOGICAL CRITERIA

The following are the radiological acceptance criteria for the T-Plant facility.

6.4.1 Total Dose Equivalent Curie Limits

The maximum quantity per container is 50 DE-Ci (HNF-SD-WM-ISB-006).

Additionally, T-Plant has total facility inventory limits as described in HNF-SD-WM-ISB-006. Waste receipts will be controlled by the facility to maintain the inventory within these limits.

6.4.2 Criticality Safety Limits

Individual waste containers must meet the limits of Appendix B.

Additionally, individual buildings within the T-Plant facility have total fissile material limits. Waste receipts will be controlled by the facility to maintain the inventory within these limits. (CPS-D-149-00001, CSAR-86-007)

6.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall meet the limits of Table 2-2 of HNF-5173. For returnable overpacks, this criteria also applies to the outside of the inner package.

6.4.4 Package External Dose Rate Limits

Waste packages that exceed 1 milliSievert per hour (100 millirem) per hour at 30 centimeters from the waste package or 2 milliSieverts per hour (200 millirem per hour) at any point on the surface of the package require case-by-case evaluation for acceptance. When these dose rates are exceeded, the generator must provide detailed radiological survey data.

6.4.5 Internal Dose Rate and Contamination Limits for Decontamination and Processing

The contact dose rate for equipment and waste to be decontaminated or processed will be determined on a case-by-case basis during acceptance review. When internal contact dose rates exceed 1 milliSievert per hour (100 millirem per hour), the generator must provide detailed radiological survey information.

In addition, items with detectable alpha contamination may not be acceptable for decontamination or processing at 2706-T Building. If the waste contains detectable alpha contamination, the generator must provide detailed radiological survey information to determine whether the waste can be processed.

6.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance of waste at T-Plant facility.

6.5.1 Container Selection

Waste packages that meet one of the following criteria will provide adequate containment.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

6.5.2 Noncombustible Containers

Outer containers shall be constructed of metal, except that fire-retardant wood boxes can be used.

6.5.3 Protective Coatings and Liners for Stored Waste

The packaging for waste to be stored shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste as follows.

- The exterior coating of containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.
- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WMP acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

6.5.4 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, dents, bulges, pit or scale corrosion, or other damage that could compromise integrity (WAC-173-303-630). Minor external surface rust that could be sanded or brushed off will be acceptable. Containers having some pit or scale corrosion could be acceptable for storage provided the integrity of the container is confirmed by NDE.

6.5.5 Securing Waste and Shielding

Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

6.5.6 Container Size Limits

Container size limits are as follows:

- 2706-T: 12.2 meters (40 feet) long by 4.3 meters (14 feet) high by 3.7 meters (12 feet) wide
- 221-T: 6.7 meters (22 feet) long by 4.0 meters (13 feet) high by 5.5 meters (18 feet) wide
- 214-T: 6.0 meters (20 feet) long by 3.0 meters (10 feet) high by 3 meters (10 feet) wide.

These size limits may be exceeded on a case-by-case basis with approval from facility operations via a waste profile.

6.5.7 Container Weight Limits

General container weight limits are as follows. Heavier containers can be accepted on a case-by case basis with T Plant operations approval.

- Drums shall not exceed 454 kilograms (1,000 pounds)
- Boxes shall not exceed their rated weight capacity
- Large equipment or packages shall not exceed the following limits:
 - 2706-T: 5,400 kilograms (11,900 pounds) (small vehicles); 9,100 kilograms (20,000 pounds) per axle or 36,000 kilograms (80,000 pounds) gross (heavy equipment); or 110,000 kilograms (243,000 pounds) (rail rolling stock). All limits except rail rolling stock can be exceeded on a case-by-case basis.
 - 221-T: 41,000 kilograms (90,000 pounds).

6.5.8 Labeling

Packages shall be labeled according to instructions contained in Appendix C.

7.0 ACCEPTANCE CRITERIA FOR THE WASTE RECEIVING AND PROCESSING FACILITY

The following acceptance criteria apply to newly generated waste sent to WRAP. Newly generated TRU waste shall be managed in accordance with Section 2.6. Acceptance criteria for retrieved waste containers in the LLBG will be established through project-specific acceptance procedures.

7.1 FACILITY DESCRIPTION AND FUNCTION

WRAP is a treatment and storage unit. WRAP receives waste containers for verification, sampling, NDA, NDE, treatment, and repackaging.

Waste that can be managed at WRAP includes TRU waste, TRU mixed waste, low-level waste, low-level mixed, and TSCA PCB waste. WRAP manages waste having characteristic waste numbers D001 through D043, all listed discarded chemical product waste numbers (U- and P- listed wastes), certain F-listed waste numbers (F001 through F005, F020 through F023, F026 through F028, and F039), and all Washington state-only waste numbers (DOE/RL-88-21). In addition, WRAP manages TSCA PCB waste.

Waste managed at WRAP could be sent to other Hanford Site TSD units for treatment, storage, and/or disposal. The acceptance criteria for these TSD units must be met subsequent to reprocessing waste at WRAP.

7.2 PROHIBITED WASTE

The following wastes types are not accepted at WRAP:

- Waste having dangerous waste numbers other than those listed on the WRAP Part A, Form 3, permit application (DOE-RL-88-21). The prohibited waste numbers are F006 through F019, F024, F025, F032 through F038, and all K waste numbers)
- Waste generated from CERCLA cleanup activities, unless specific approval (e.g., a Record of Decision) has been granted by the EPA to manage the waste on the Hanford Site
- Explosive waste (HNF-2165)
- Shock-sensitive waste (HNF-2165)
- Pyrophoric waste (HNF-2165)
- Class IV oxidizer (see definitions) waste (HNF-2165)
- Waste that is readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable. (DOE M 435.1-1, Chapters III and IV, N.1)
- Liquid waste, except that inner containers having less than 57 liters (15 gallons) of liquid are acceptable (HNF-2165)

- Compressed gases packaged at pressures in excess of 1.5 atmospheres (152 kilopascals absolute pressure) at 20°C (68°F), except that aerosol cans can be accepted as long as the total quantity of propane in an outer container does not exceed 900 grams (2 pounds) (HNF-SD-W026-SAR-002)
- Waste that exceeds any of the radiological limits of Section 7.4
- Infectious waste.

7.3 PHYSICAL/CHEMICAL CRITERIA

The following are the physical and chemical acceptance criteria for WRAP.

7.3.1 Chemical Compatibility

All waste placed in a given outer container shall be chemically compatible (WAC 173-303-630).

7.3.2 Hazardous Material Limits

The WRAP safety basis has a method for determining limits on the quantity of hazardous material in each container (HNF-SD-W026-SAR-002). Generators should contact the WMP acceptance organization for any waste containing hazardous chemical constituents to determine the quantity per container allowed at WRAP.

7.3.3 Asbestos Containing Waste

Asbestos-containing waste material shall be packaged in accordance with 40 CFR 61.150. Wetting with water is allowed as long as the liquid does not exceed applicable free liquid requirements.

7.3.4 Heat Generation

If heat generation from radiological decay in the waste package exceeds 3.5 watts per cubic meter (0.1 watt per cubic foot), the package must be evaluated to ensure that the heat does not affect the integrity of the container or surrounding containers. This evaluation must be provided to and approved by the WMP acceptance organization.

7.3.5 Gas Generation

- Vents or other mechanisms to prevent pressurization of containers or generation of flammable or explosive concentrations of gases shall be installed on containers of newly-generated transuranic waste at the time the waste is packaged. (DOE M 435.1-1, Chapter III, L.1.b.)
- When low-level waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container. (DOE M 435.1-1, Chapter IV, L.1.b). Generators shall vent all containers exceeding 0.007 Watts/cubic meter or provide information demonstrating compliance with DOE M 435.1-1, Chapter IV, L.1.b. (RMIS Accession No. D8882672)

If required, the following mitigating measures (or alternative measures approved by the WMP acceptance organization) must be used.

- Control of hydrogen from radiolytic decomposition: use a Nucfil 013™ filter or equivalent. All container liners and inner bags must be closed in a manner that allows gas to reach the vent filter (e.g., twist and tape method for bags). In addition to filtering, palladium or platinum catalyst packs must be used to control hydrogen concentrations in the container when filtering alone is insufficient to maintain hydrogen gas concentrations below the lower explosive limit.
- Control of gases from biological decomposition: waste containing readily decomposable organic materials (e.g., vegetation) must be vented with a Nucfil 013™ filter or equivalent. In addition to filtering, slaked lime could be required for waste that is expected to decompose rapidly.

7.4 RADIOLOGICAL CRITERIA

The following are the radiological acceptance criteria for WRAP.

7.4.1 Container Dose-Equivalent Curie Limits

The maximum DE-Ci content per container is as follows. Other container types and sizes must be evaluated for acceptance (HNF-SD-W026-SAR-002).

- 35 DE-Ci per drum
- 35 DE-Ci per wood waste box
- 56.9 DE-Ci per standard waste box.

7.4.2 Criticality Safety Limits

The fissile and fissionable material content limits are provided in Appendix B (WRP1-CPS-001).

7.4.3 Package External Contamination Limits

Removable contamination on accessible surfaces of waste packages shall not exceed the limits of Table 2-2 of HNF-5173. For returnable overpacks, this criteria also applies to the outside of the inner package.

7.4.4 Package External Dose Rate Limits

Waste packages shall not exceed 1 milliSievert per hour (100 millirem per hour) at 30 centimeters (1 foot) from the waste package and 2 milliSieverts per hour (200 millirem) per hour at any point on the surface of the package.

7.5 PACKAGING CRITERIA

The following are the packaging criteria for acceptance at WRAP.

7.5.1 Container Selection

Waste packages must meet one of the following criteria to provide adequate containment.

- Packages that meet the applicable requirements of 49 CFR. If the waste does not meet the definition of any DOT hazard class, a container meeting the general requirements of 49 CFR 173.410 is adequate.
- Packages that have been evaluated through an approved packaging safety analysis.

7.5.2 Protective Coatings and Liners for Stored Waste

The packaging for mixed waste to be stored shall include coatings and/or liners sufficient to maintain the integrity of the containment system during the anticipated storage life of the waste.

- The exterior coating of metal containers shall be alkyd enamel, galvanized, or an alternative coating with performance equivalent to or better than alkyd enamel.
- The interior coatings and liners shall be chemically compatible with the waste and shall protect the containment system from corrosion over the anticipated storage life of the waste (WAC 173-303-630). Unless otherwise specified by the WMP acceptance organization, the storage life should be assumed to be 20 years. For containers procured under Hanford Site container procurement specifications, Appendix D defines preferred coating and liner options.

7.5.3 Noncombustible Containers

Outer containers shall be constructed of metal, except that fire-retardant wood boxes can be used for low-level waste only. Additionally, wood boxes must be overpacked in a metal box for NDA at WRAP (HNF-SD-W026-SAR-002).

7.5.4 Condition of Containers

Outer containers shall be in good condition, with no visible cracks, holes, dents, bulges, pit or scale corrosion, or other damage that could compromise integrity. Minor external surface rust that could be sanded or brushed off will be acceptable. Containers having some pit or scale corrosion could be acceptable for storage provided the integrity of the container is confirmed by NDE.

7.5.5 Securing Waste and Shielding

Large heavy items must be secured in containers by bracing, blocking, or other means to prevent damage to the container during handling and transportation. When shielding is used to reduce the surface dose rate of a waste container, the shielding and waste must be secured to prevent shifting during handling and transportation.

7.5.6 Package Size Limits

The container sizes that can be handled at WRAP are as follows:

- Drums not exceeding 321 liter (85 gallon)
- Boxes less than the following dimensions can be received for NDE and/or NDA:
 - NDE: Waste packaged in containers 3.05 meters long by 1.65 meters wide at bottom or 1.93 meters wide above 0.61 meters from bottom by 1.83 meters high (10 feet long by 5 feet 4 inches wide at bottom or 6 feet 4 inches wide above 2 feet from bottom by 6 feet high). These dimensions are absolute dimensions including any attachments such as lifting bails, lid flanges, etc.
 - NDA: Waste packaged in containers 2.43 meters long by 1.5 meters wide by 1.5 meters high (nominally 8 feet long by 5 feet wide by 5 feet high). These dimensions are absolute dimensions including any attachments such as lifting bails, lid flanges, etc.

7.5.7 Package Weight Limits

The maximum weight for containers handled at WRAP is as follows:

- Drums: 454 kilograms (1,000 pounds)
- SWB: 1,800 kilograms (3,970 pounds)
- Other Boxes: 3,180 kilograms (7,000 pounds).

7.5.8 Labeling

Packages shall be labeled as described in Appendix C.

8.0 REFERENCES

- 10 CFR 830.120, *Quality Assurance Requirements*.
- ANSI/ANS 8.15, *Nuclear Criticality Control of Special Actinide Elements*, American National Standards Institute, Washington, D.C.
- ASTM E-84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, ASTM Standard E-84, American Society for Testing of Materials, Philadelphia, Pennsylvania
- Chu, S.Y.F., L.P. Ekstrom, and R.B. Firestone, WWW Table of Radioactive Isotopes, database version 02/08/99 from URL <http://nucleardata.nuclear.lu.se/nucleardata/toi>
- CPS-D-149-00001, *Criticality Prevention Specification: T Plant Canyon Operations*, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- CPS-SW-006, *Criticality Prevention Specification: Absorbed Plutonium Nitrate Solutions in Lined Drums*
- CPS-SW-149-00002, *Criticality Prevention Specification: Waste Storage - Central Waste Complex*, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- CPS-SW-149-00003, *Criticality Prevention Specification: Waste Storage - 200 Area Low-Level Burial Grounds*, Waste Management Federal Services of Hanford, Inc., Richland, Washington.
- CPS-T-149-00025, *Criticality Prevention Specification: Underground or Above-Grade Storage of Organic Liquid Contaminated with TRU Radionuclides*, Westinghouse Hanford Company, Richland, Washington.
- CSAR-86-007, *Classification of the 221-T Building as a Limited Control Facility*, Westinghouse Hanford Company, Richland, Washington
- DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*, U.S. Department of Energy, Washington, D.C.
- DOE M 435.1-1, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.
- DOE Order 414.1A, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.
- DOE Order 435.1, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.
- DOE Order 474.1, *Control and Accountability of Nuclear Materials*, U.S. Department of Energy, Washington, D.C.
- DOE-RL-88-21, *Hanford Facility Dangerous Waste Permit, Part A Permit Application*, U.S. Department of Energy Richland Operations Office, Richland, Washington.
- DOE-RL-91-31, *Hanford Site Waste Minimization and Pollution Prevention Awareness Program Plan*, U.S. Department of Energy Richland Operations Office, Richland, Washington.

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APPENDIX A

RADIOLOGICAL CALCULATION METHODS

A variety of radiological calculations are required to determine whether a waste can be managed at Hanford Site TSD units. The following sections describe the methodology for performing these calculations. For each calculation, the following assumptions shall be used.

- All major radionuclides in the waste, as defined in Section 2.4.1, must be considered in the calculations. If there is a major radionuclide in the waste that is not listed in Tables A-1 and A-2, the generator must notify the WMP acceptance organization to calculate the applicable limits and conversion factors.
- If a daughter radionuclide has a half-life less than 10 days and the parent radionuclide has a half-life greater than the daughter, the activity of the daughter should not be considered in the calculations.
- The internal volume of the outer waste container should be used when limits are expressed in volume concentration. If the waste is not containerized, the volume is the anticipated volume the waste will occupy in the TSD unit.

A.1. TRANSURANIC WASTE DETERMINATION

To determine whether a waste is TRU, compute the sum of the specific activity of the alpha-emitting radionuclides having half-lives greater than 20 years. These radionuclides are identified by footnote b in Table A-2. If the total alpha activity exceeds 100 nanocuries per gram, the waste is TRU.

Determination of the mass over which the activity is divided in making the waste determination is the waste matrix, which excludes the mass of added shielding, the container, and any rigid liners (DOE G 435.1-1). The determination whether to include the mass of stabilization media and similar materials added to meet waste acceptance criteria should be in accordance with DOE G 435.1-1, Chapter III.A.

A.2. CALCULATION OF PLUTONIUM-239 FISSILE GRAM EQUIVALENTS

Fissile gram equivalent (FGE) is defined as the amount of plutonium-239 (in grams) that will produce the equivalent reactivity as another nuclide at optimal shape, moderation, and reflection. FGE normally is calculated as follows:

Multiply the grams of each fissionable isotope by the FGE conversion factor (FGE per gram) in Appendix B, Table B-1, to yield the FGE for the isotope. Sum the FGE for each fissionable isotope to maintain a total FGE for all isotopes. The conversion for each nuclide is to be carried out as specified in the following equation, and summed for the waste package:

$$\text{Isotope mass (grams)} \times \text{isotope conversion factor (FGE/gram)} = \text{Isotope FGE.}$$

If there is more than one gram of uranium-235, the facility criticality safety representative could use an alternate method for determining the FGE for uranium-235 as discussed in Appendix B. Natural uranium (i.e., 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent) is always exempt for criticality

purposes at TSD units.

A.3. CALCULATION OF THERMAL POWER

The thermal power of the waste in a container is calculated from the concentration of radionuclides in the waste and the heat of decay from Table A-1. The thermal power calculation is performed in the following steps:

1. The concentration of each radionuclide (expressed in curies per cubic meter) is multiplied by the heat of decay for that nuclide from Table A-1, yielding the heat of decay for each in units of watts per cubic meter
2. Thermal power is the sum of the heat of decay of all radionuclides in the waste.

A.4. CATEGORY 1 DETERMINATION

Classification of waste as Category 1 or greater than Category 1 is a sum of fractions calculation, performed in the following steps.

1. The concentration of each nuclide (expressed in curies per cubic meter) is divided by its respective Category 1 limit (Table A-2).
2. The resulting values are added to form the sum of fractions.
3. If the sum of fractions is less than or equal to 1, the waste is Category 1. If the sum of fractions exceeds 1, the waste is greater than Category 1, and the Category 3 determination must be performed to classify the waste.

A.5. CATEGORY 3 DETERMINATION

Category 3 determination is performed in the same way as the Category 1 calculation, only using the Category 3 limits from Table A-2 as follows.

1. The concentration of each nuclide (expressed in curies per cubic meter) is divided by its respective Category 3 limit from Table A-2.
2. The resulting values are added to form a sum of fractions.
3. If the sum of fractions is less than or equal to 1, the waste is Category 3. If the sum of fractions exceeds 1, the waste is greater than Category 3.

A.6. INTERIM SAFETY BASIS CALCULATIONS FOR LOW-LEVEL BURIAL GROUNDS

The ISB calculations are sum of fractions calculations, performed in the following steps:

1. Determine the appropriate set of limits from Table A-2 (i.e., noncombustible containerized waste or combustible containerized waste)

2. Divide the concentration of each radionuclide by the limit
3. Add the resulting values to form a sum of fractions
4. If the sum of fractions is less than or equal to 1, the waste lies within the ISB limits. The noncombustible waste limit cannot be exceeded. If combustible waste exceeds the combustible waste limit, but does not exceed the noncombustible waste limit, the WMP acceptance organization can perform an evaluation to determine whether segregation or stabilization can be used to mitigate the combustibility hazard.

A.7. MOBILE RADIONUCLIDE REPORTING

This is a simple comparison of the concentration of each mobile radionuclide (^3H , ^{14}C , ^{36}Cl , ^{79}Se , ^{93}Mo , ^{99}Tc , ^{129}I , ^{187}Re , Total U, and ^{237}Np) against its respective reporting value from Table A-2.

A.8. CALCULATING DOSE-EQUIVALENT CURIES

Calculation of DE-Ci is a method of normalizing the exposure risk of various radionuclides. DE-Ci limits are established for certain TSD units as part of the safety basis. Calculation of the DE-Ci of a waste container is performed in the following steps:

1. Multiply the activity (in Ci) of each isotope in a given container by its respective DE-Ci correction factor from Table A-1
2. Add the resulting values to obtain the total DE-Ci of the package.

A.9. CALCULATING PLUTONIUM-239 EQUIVALENT CURIES

The PE-Ci calculation is required for TRU waste to be shipped to WIPP. The PE-Ci calculation is performed as specified in the WIPP waste acceptance criteria (DOE/WIPP-02-3122).

Table A-1. Conversion Factor for General Radiological Calculations.

Isotope	Half-Life (sec)	Specific Activity (Ci/g)	Decay Heat (W/Ci)	DE-Ci Factor
³ H	3.891 E+08	9.613 E+03	3.383 E-05	1.49 E-07
⁷ Be	4.605 E+06	3.491 E+05	1.996 E-03	7.47 E-07
¹⁰ Be	5.049 E+13	2.231 E-02	1.495 E-03	8.25 E-04
¹⁴ C	1.808 E+11	4.455 E+00	2.933 E-04	4.86 E-06
²² Na	8.214 E+07	6.244 E+03	1.420 E-02	1.78 E-05
³² P	1.232 E+06	2.864 E+05	4.119 E-03	3.61 E-05
³² Si	5.428 E+09	6.500 E+01	4.079 E-04	2.36 E-03
³³ P	2.195 E+06	1.559 E+05	4.539 E-04	5.41 E-06
³⁵ S	7.560 E+06	4.267 E+04	2.895 E-04	5.76 E-06
³⁶ Cl	9.530 E+12	3.291 E-02	1.622 E-03	5.11 E-05
³⁹ Ar	8.489 E+09	3.411 E+01	1.296 E-03	6.13 E-16
⁴⁰ K	4.039 E+16	6.989 E-06	4.025 E-03	2.87 E-05
⁴² Ar	1.041 E+09	2.582 E+02	1.381 E-03	6.13 E-16
⁴⁴ Ti*	1.490 E+09	1.722 E+02	1.708 E-02	2.37 E-03
⁴⁵ Ca	1.406 E+07	1.785 E+04	4.577 E-04	1.54 E-05
⁴⁶ Sc	7.242 E+06	3.390 E+04	1.258 E-02	6.90 E-05
⁴⁹ V	2.851 E+07	8.084 E+03	2.685 E-05	8.04 E-07
⁵¹ Cr	2.394 E+06	9.251 E+04	2.170 E-04	7.78 E-07
⁵⁴ Mn	2.698 E+07	7.751 E+03	4.981 E-03	1.56 E-05
⁵⁵ Fe	8.631 E+07	2.379 E+03	3.492 E-05	6.25 E-06
⁵⁶ Co	6.679 E+06	3.020 E+04	2.200 E-02	9.22 E-05
⁵⁷ Co	2.348 E+07	8.438 E+03	8.536 E-04	2.11 E-05
⁵⁸ Co	6.122 E+06	3.181 E+04	5.990 E-03	2.53 E-05
⁵⁹ Fe	3.845 E+06	4.979 E+04	7.749 E-03	3.44 E-05
⁵⁹ Ni	2.398 E+12	7.982 E-02	4.248 E-05	3.08 E-06
⁶⁰ Co	1.664 E+08	1.131 E+03	1.542 E-02	5.09 E-04
⁶³ Ni	3.124 E+09	5.738 E+01	1.016 E-04	7.23 E-06
⁶⁵ Zn	2.110 E+07	8.233 E+03	3.495 E-03	4.75 E-05
⁶⁸ Ge	2.340 E+07	7.098 E+03	5.264 E-05	1.20 E-04
⁷⁵ Se	1.034 E+07	1.457 E+04	2.400 E-03	1.97 E-05
⁷⁹ Se	2.051 E+12	6.969 E-02	6.019 E-04	2.29 E-05
⁸² Sr	2.208 E+06	6.237 E+04	7.665 E-05	1.43 E-04
⁸³ Rb	7.448 E+06	1.827 E+04	2.934 E-03	1.15 E-05
⁸⁴ Rb	2.831 E+06	4.749 E+04	6.236 E-03	1.52 E-05
⁸⁵ Kr	3.383 E+08	3.927 E+02	1.498 E-03	1.64 E-14
⁸⁵ Sr	5.603 E+06	2.371 E+04	3.128 E-03	1.17 E-05
⁸⁶ Rb	1.612 E+06	8.145 E+04	4.518 E-03	1.54 E-05
⁸⁸ Y	9.213 E+06	1.393 E+04	1.603 E-02	6.54 E-05
⁸⁹ Sr	4.365 E+06	2.907 E+04	3.460 E-03	9.65 E-05
⁹⁰ Sr*	9.037 E+08	1.388 E+02	6.695 E-03	3.04 E-03
⁹¹ Nb	2.146 E+10	5.783 E+00	1.021 E-04	9.65 E-04
⁹³ Mo	9.504 E+10	1.278 E+00	9.834 E-05	6.62 E-05
^{93m} Nb	5.089 E+08	2.386 E+02	1.834 E-04	6.81 E-05
⁹³ Zr	4.828 E+13	2.515 E-03	1.130 E-04	7.47 E-04
⁹⁴ Nb	6.307 E+11	1.905 E-01	1.031 E-02	9.65 E-04
⁹⁵ Nb	3.022 E+06	3.934 E+04	4.795 E-03	1.35 E-05
⁹⁵ Zr*	5.532 E+06	2.149 E+04	5.047 E-03	6.09 E-05

Table A-1. Conversion Factor for General Radiological Calculations.

Isotope	Half-Life (sec)	Specific Activity (Ci/g)	Decay Heat (W/Ci)	DE-Ci Factor
⁹⁹ Tc	6.668 E+12	1.711 E-02	5.986 E-04	1.93 E-05
¹⁰⁵ Ru*	3.392 E+06	3.232 E+04	3.578 E-03	2.08 E-05
¹⁰⁶ Ru*	3.181 E+07	3.349 E+03	9.670 E-03	1.11 E-03
¹⁰⁷ Pd	2.050 E+14	5.148 E-04	5.513 E-05	2.97 E-05
^{108m} Ag*	1.319 E+10	7.926 E+00	1.008 E-02	6.60 E-04
¹⁰⁹ Cd-109	3.997 E+07	2.592 E+03	1.237 E-04	2.66 E-04
^{110m} Ag*	2.158 E+07	4.756 E+03	1.687 E-02	1.87 E-04
^{113m} Cd	4.323 E+08	2.311 E+02	1.086 E-03	3.56 E-03
¹¹³ Sn*	9.944 E+06	1.005 E+04	2.498 E-03	2.48 E-05
^{119m} Sn	2.532 E+07	3.748 E+03	5.313 E-04	1.45 E-05
^{121m} Sn	1.736 E+09	5.376 E+01	2.396 E-04	2.68 E-05
¹²¹ Te	1.450 E+06	6.435 E+04	3.471 E-03	4.43 E-06
¹²³ Te	3.154 E+20	2.911 E-10	1.342 E-05	2.45 E-05
¹²⁴ Sb	5.205 E+06	1.749 E+04	1.331 E-02	5.86 E-05
¹²⁵ I	5.135 E+06	1.759 E+04	3.655 E-04	5.62 E-05
¹²⁵ Sb	8.707 E+07	1.037 E+03	3.150 E-03	2.84 E-05
^{125m} Te	5.011 E+06	1.802 E+04	8.582 E-04	1.69 E-05
¹²⁶ Sb	1.071 E+06	8.363 E+04	1.847 E-02	2.73 E-05
¹²⁶ Sn*	3.156 E+12	2.839 E-02	1.056 E-03	2.31 E-04
^{127m} Te*	9.418 E+06	9.440 E+03	1.870 E-03	5.07 E-05
¹²⁹ I	4.951 E+14	1.768 E-04	4.633 E-04	4.04 E-04
^{129m} Te*	2.920 E+06	2.997 E+04	4.127 E-03	5.57 E-05
^{131m} Xe	1.028 E+06	8.382 E+04	9.622 E-04	6.07 E-12
¹³⁵ Ba	3.337 E+08	2.544 E+02	2.705 E-03	1.81 E-05
¹³⁴ Cs	6.517 E+07	1.293 E+03	1.018 E-02	1.08 E-04
¹³⁵ Cs	7.574 E+13	1.104 E-03	3.964 E-04	1.06 E-05
¹³⁷ Cs*	9.521 E+08	8.655 E+01	4.816 E-03	7.44 E-05
¹⁴⁰ Ba*	1.101 E+06	7.326 E+04	2.236 E-02	8.70 E-06
¹⁴¹ Ce	2.808 E+06	2.851 E+04	1.467 E-03	2.08 E-05
¹⁴⁴ Ce*	2.462 E+07	3.185 E+03	7.996 E-03	8.70 E-04
¹⁴⁷ Nd	9.487 E+05	8.094 E+04	2.432 E-03	1.59 E-05
¹⁴⁷ Pm	8.278 E+07	9.277 E+02	3.676 E-04	9.13 E-05
¹⁴⁷ Sm	3.343 E+18	2.297 E-08	1.361 E-02	1.74 E-01
¹⁵⁰ Eu	1.079 E+09	6.977 E+01	9.532 E-03	6.25 E-04
¹⁵¹ Sm	2.840 E+09	2.632 E+01	1.179 E-04	6.98 E-05
¹⁵² Eu	4.267 E+08	1.740 E+02	7.667 E-03	5.14 E-04
¹⁵² Gd	3.406 E+21	2.180 E-11	1.303 E-02	5.67 E-01
¹⁵³ Gd	2.091 E+07	3.528 E+03	8.622 E-04	5.54 E-05
¹⁵⁴ Eu	2.712 E+08	2.703 E+02	9.009 E-03	6.66 E-04
¹⁵⁵ Eu	1.529 E+08	4.762 E+02	7.749 E-04	9.65 E-05
¹⁷⁰ Tm	1.111 E+07	5.975 E+03	1.982 E-03	6.12 E-05
¹⁷⁵ Hf	6.048 E+06	1.066 E+04	2.422 E-03	1.30 E-05
¹⁸¹ Hf	3.662 E+06	1.703 E+04	4.357 E-03	3.59 E-05
¹⁸² Ta	9.910 E+06	6.257 E+03	8.890 E-03	1.04 E-04
¹⁸⁵ W	6.489 E+06	9.401 E+03	7.520 E-04	1.75 E-06
¹⁸⁷ Re	1.577 E+18	3.827 E-08	3.913 E-06	1.26 E-07
¹⁹⁵ Au	1.608 E+07	3.599 E+03	7.629 E-04	3.01 E-05

Table A-1. Conversion Factor for General Radiological Calculations.

Isotope	Half-Life (sec)	Specific Activity (Ci/g)	Decay Heat (W/Ci)	DE-Ci Factor
²⁰³ Hg	4.026 E+06	1.381 E+04	1.997 E-03	1.70 E-05
²⁰⁴ Tl	1.196 E+08	4.624 E+02	1.407 E-03	5.60 E-06
²⁰⁷ Bi	1.002 E+09	5.438 E+01	9.829 E-03	4.66 E-05
²¹⁰ Pb	7.037 E+08	7.634 E+01	2.661 E-04	3.16 E-02
²¹⁰ Po	1.196 E+07	4.493 E+03	3.206 E-02	2.18 E-02
²²⁶ Ra	5.049 E+10	9.885 E-01	2.888 E-02	2.00 E-02
²²⁷ Ac	6.871 E+08	7.232 E+01	5.021 E-04	4.00 E+00
²²⁸ Ra	1.815 E+08	2.727 E+02	1.391 E-04	1.11 E-02
²²⁸ Th	6.037 E+07	8.195 E+02	3.272 E-02	7.95 E-01
²²⁹ Th	2.316 E+11	2.127 E-01	3.055 E-02	5.00 E+00
²³⁰ Th	2.379 E+12	2.061 E-02	2.822 E-02	7.58 E-01
²³¹ Pa	1.034 E+12	4.723 E-02	3.054 E-02	2.99 E+00
²³² Th	4.434 E+17	1.097 E-07	2.426 E-02	3.81 E+00
²³² U	2.203 E+09	2.207 E+01	3.210 E-02	1.53 E+00
²³³ U	5.026 E+12	9.633 E-03	2.912 E-02	3.15 E-01
²³⁴ Th	2.082 E+06	2.315 E+04	4.268 E-04	8.16 E-05
²³⁴ U	7.754 E+12	6.217 E-03	2.880 E-02	3.08 E-01
²³⁵ U	2.221 E+16	2.161 E-06	2.773 E-02	2.86 E-01
²³⁶ Pu	9.152 E+07	5.222 E+02	3.478 E-02	3.37 E-01
²³⁶ U	7.390 E+14	6.468 E-05	2.712 E-02	2.92 E-01
²³⁷ Np	6.753 E+13	7.047 E-04	2.944 E-02	1.25 E+00
²³⁸ Pu	2.768 E+09	1.712 E+01	3.315 E-02	9.13 E-01
²³⁸ U	1.410 E+17	3.361 E-07	2.532 E-02	2.75 E-01
²³⁹ Pu	7.609 E+11	6.202 E-02	3.109 E-02	1.00E+00
²⁴⁰ Pu	2.071 E+11	2.269 E-01	3.115 E-02	1.00 E+00
²⁴¹ Am	1.366 E+10	3.427 E+00	3.343 E-02	1.03 E+00
²⁴¹ Pu	4.544 E+08	1.030 E+02	3.177 E-05	1.92 E-02
^{242m} Am	4.450 E+09	1.047 E+01	4.288 E-04	9.91 E-01
²⁴² Cm	1.408 E+07	3.311 E+03	3.682 E-02	4.02 E-02
²⁴² Pu	1.179 E+13	3.954 E-03	2.955 E-02	9.56 E-01
²⁴³ Am	2.324 E+11	1.997 E-01	3.225 E-02	1.02 E+00
²⁴³ Cm	9.467 E+08	4.903 E+01	3.683 E-02	7.15 E-01
²⁴⁴ Cm	5.712 E+08	8.093 E+01	3.499 E-02	5.77 E-01
²⁴⁴ Pu	2.525 E+15	1.831 E-05	2.909 E-02	9.39 E-01
²⁴⁵ Cm	2.682 E+11	1.716 E-01	3.334 E-02	1.06 E+00
²⁴⁶ Cm	1.493 E+11	3.072 E-01	3.282 E-02	1.05 E+00
²⁴⁷ Bk	4.352 E+10	1.049 E+00	3.425 E-02	1.34 E+00
²⁴⁷ Cm	5.049 E+14	9.043 E-05	3.174 E-02	9.65 E-01
²⁴⁸ Cm	1.073 E+13	4.239 E-03	1.244 E-01	3.85 E+00
²⁴⁹ Cf	1.108 E+10	4.089 E+00	3.945 E-02	1.34 E+00
²⁵⁰ Cf	4.128 E+08	1.093 E+02	3.727 E-02	6.10 E-01
²⁵⁰ Cm	2.525 E+11	1.787 E-01	8.263 E-01	2.18 E+01
²⁵¹ Cf	2.834 E+10	1.586 E+00	3.663 E-02	1.37 E+00
²⁵² Cf	8.347 E+07	5.362 E+02	7.258 E-02	3.65 E-01
²⁵⁴ Es	2.380 E+07	1.865 E+03	5.779 E-02	9.56 E-02

* Daughters with half-life less than 10 days (8.64×10^5 sec) and with parent radionuclide half-life greater than the daughter are not reportable as separate isotopes. Contributions from nonreportable daughters have been included in the decay heat and dose-equivalence factors.

Half-life data: S.Y.F. Chu, L.P. Ekstrom, and R.B. Firestone, WWW Table of Radioactive Isotopes, database version 02/08/99 from URL <http://nucldata.nuclear.lu.se/nucldata/toi>

Specific activity data: DWB-01-0801, "Revised Table A-1 of HNF-EP-0063".

Decay heat: ORIGEN database.

DE-Ci: HNF-SD-W026-SAR-002; HNF-SD-WM-ISB-007.

Note: The conversion factor from second to years is $3.155\text{E}+07$ sec/yr.

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m ³)	Category 1 waste limit (Ci/m ³)	Category 3 waste limit (Ci/m ³)	ISB Non-combustible waste limit (Ci/m ³)	ISB Combustible waste limit (Ci/m ³)
³ H	4.4 E+00	9.9 E+04	NL	4.00 E+07	5.00 E+02
⁷ Be	NL	NL	NL	2.64 E+07	6.59 E+05
¹⁰ Be	NL	1.1 E+00	2.4 E+02	1.00 E+04	2.50 E+02
¹⁴ C	1.3 E-04	9.1 E-02	2.1 E+01	1.76 E+06	4.41 E+04
¹⁴ C act. metal ^a	NL	9.1 E-01	2.1 E+02	1.76 E+06	4.41 E+04
²² Na	NL	NL	NL	4.29 E+05	1.07 E+04
³² P	NL	NL	NL	2.31 E+05	5.77 E+03
³² Si	NL	7.3 E-01	3.6 E+02	3.58 E+03	8.95 E+01
³³ P	NL	NL	NL	1.57 E+06	3.92 E+04
³⁵ S	NL	NL	NL	1.46 E+06	3.66 E+04
³⁶ Cl	3.1 E-05	6.4 E-05	1.4 E-01	1.70 E+05	4.17 E+03
³⁹ Ar	NL	NL	NL	2.00 E+10	2.50 E+05
⁴⁰ K	NL	1.8 E-03	3.8 E-01	3.00 E+05	7.50 E+03
⁴² Ar	NL	NL	NL	2.00 E+10	2.50 E+05
⁴⁴ Ti	NL	6.3 E-03	4.7 E+02	3.57 E+03	8.93 E+01
⁴⁵ Ca	NL	NL	NL	5.45 E+05	1.36 E+04
⁴⁶ Sc	NL	NL	NL	1.22 E+05	3.06 E+03
⁴⁹ V	NL	NL	NL	1.05 E+07	2.63 E+05
⁵¹ Cr	NL	NL	NL	1.00 E+07	2.50 E+05
⁵⁴ Mn	NL	NL	NL	5.22 E+05	1.30 E+04
⁵⁵ Fe	NL	NL	NL	1.33 E+06	3.33 E+04
⁵⁶ Co	NL	NL	NL	9.16 E+04	2.29 E+03
⁵⁷ Co	NL	NL	NL	4.29 E+05	1.07 E+04
⁵⁸ Co	NL	NL	NL	3.24 E+05	8.11 E+03
⁵⁹ Fe	NL	NL	NL	2.35 E+05	5.88 E+03
⁵⁹ Ni	NL	3.9 E+00	8.5 E+02	2.86 E+06	7.14 E+04
⁵⁹ Ni act. metal ^a	NL	3.9 E+01	8.5 E+03	2.86 E+06	7.14 E+04
⁶⁰ Co	NL	7.5 E+01	NL	1.82 E+04	4.55 E+02
⁶⁰ Co act. metal ^a	NL	7.5 E+02	NL	1.82 E+04	4.55 E+02
⁶³ Ni	NL	5.9 E+00	2.0 E+04	1.20 E+06	3.00 E+04
⁶³ Ni act. metal ^a	NL	5.9 E+01	2.0 E+05	1.20 E+06	3.00 E+04
⁶⁵ Zn	NL	NL	NL	1.97 E+05	4.92 E+03
⁶⁸ Ge	NL	NL	NL	7.02 E+04	1.75 E+03
⁷⁵ Se	NL	NL	NL	4.29 E+05	1.07 E+04
⁷⁹ Se	3.4 E-05	5.1 E-01	1.1 E+02	3.87 E+05	9.68 E+03
⁸² Sr	NL	NL	NL	5.91 E+04	1.48 E+03
⁸³ Rb	NL	NL	NL	7.39 E+05	1.85 E+04
⁸⁴ Rb	NL	NL	NL	5.58 E+05	1.40 E+04
⁸⁵ Kr	NL	NL	NL	2.11 E+09	2.63 E+04
⁸⁵ Sr	NL	NL	NL	1.97 E+06	4.92 E+04
⁸⁶ Rb	NL	NL	NL	5.45 E+05	1.36 E+04
⁸⁸ Y	NL	NL	NL	1.29 E+05	3.24 E+03
⁸⁹ Sr	NL	NL	NL	6.67 E+05	1.67 E+04
⁹⁰ Sr*	NL	1.6 E-02	5.4 E+04	1.50 E+04	3.75 E+02
⁹¹ Nb	NL	2.0 E+00	6.3 E+02	9.23 E+03	2.31 E+02
⁹³ Mo	2.1 E-04	8.7 E-01	2.0 E+02	1.28 E+05	3.19 E+03

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m ³)	Category 1 waste limit (Ci/m ³)	Category 3 waste limit (Ci/m ³)	ISB Non-combustible waste limit (Ci/m ³)	ISB Combustible waste limit (Ci/m ³)
^{93m} Nb	NL	NL	NL	1.21 E+05	3.03 E+03
⁹³ Zr	NL	2.50 E+00	5.40 E+02	4.62 E+03	1.15 E+02
⁹⁴ Nb	NL	2.2 E-04	4.8 E-02	9.23 E+03	2.31 E+02
⁹⁴ Nb act ^a	NL	2.2 E-03	4.8 E-01	9.23 E+03	2.31 E+02
⁹⁵ Nb	NL	NL	NL	5.71 E+05	1.43 E+04
⁹⁵ Zr*	NL	NL	NL	9.23 E+04	2.31 E+03
⁹⁹ Tc	2.1 E-04	2.3 E-02	5.0 E+00	4.00 E+05	1.00 E+04
¹⁰³ Ru*	NL	NL	NL	3.87 E+05	9.68 E+03
¹⁰⁶ Ru*	NL	NL	NL	8.00 E+03	2.00 E+02
¹⁰⁷ Pd	NL	1.5 E+01	3.3 E+03	2.86 E+05	7.14 E+03
^{108m} Ag	NL	NL	NL	2.15 E+04	5.39 E+02
¹⁰⁹ Cd	NL	NL	NL	2.45 E+04	6.12 E+02
^{110m} Ag*	NL	NL	NL	1.00 E+04	2.50 E+02
^{113m} Cd	NL	7.6 E-01	NL	1.79 E+03	4.48 E+01
¹¹³ Sn*	NL	NL	NL	3.24 E+05	8.11 E+03
^{119m} Sn	NL	NL	NL	6.00 E+05	1.50 E+04
^{121m} Sn	NL	6.7 E-01	2.2 E+04	3.08 E+05	7.69 E+03
¹²¹ Te	NL	NL	NL	1.91 E+06	4.77 E+04
¹²³ Te	NL	NL	NL	1.38 E+05	3.44 E+03
¹²⁴ Sb	NL	NL	NL	1.38 E+05	3.45 E+03
¹²⁵ I	NL	NL	NL	5.00 E+04	1.25 E+00
^{125m} Te	NL	NL	NL	2.18 E+06	5.45 E+04
¹²⁵ Sb	NL	NL	NL	2.79 E+05	6.98 E+03
¹²⁶ Sb	NL	NL	NL	2.67 E+05	6.67 E+03
¹²⁶ Sn*	NL	1.6 E-04	3.4 E-02	3.64 E+04	9.09 E+02
^{127m} Te*	NL	NL	NL	1.67 E+05	4.17 E+03
¹²⁹ I	1.0 E-06	8.5 E-03	1.8 E+00	7.06 E+03	1.76 E-01
^{129m} Te*	NL	NL	NL	1.56 E+05	3.90 E+03
^{131m} Xe	NL	NL	NL	7.50 E+08	9.38 E+03
¹³³ Ba	NL	7.1 E-01	NL	4.62 E+05	1.15 E+04
¹³⁴ Cs	NL	NL	NL	8.57 E+04	2.14 E+03
¹³⁵ Cs	NL	1.6 E-01	3.5 E+01	8.03 E+05	2.00 E+04
¹³⁷ Cs*	NL	5.5 E-03	1.2 E+04	1.20 E+05	3.00 E+03
¹⁴⁰ Ba*	NL	NL	NL	3.87 E+05	9.68 E+03
¹⁴¹ Ce	NL	NL	NL	4.14 E+05	1.03 E+04
¹⁴⁴ Ce*	NL	NL	NL	1.00 E+04	2.50 E+02
¹⁴⁷ Nd	NL	NL	NL	5.45 E+05	1.36 E+04
¹⁴⁷ Pm	NL	NL	NL	9.23 E+04	2.31 E+03
¹⁴⁷ Sm	NL	1.7 E-02	3.7 E+00	2.86 E+01	7.14 E-01
¹⁵⁰ Eu	NL	1.4 E-03	6.7 E+02	1.38 E+04	3.45 E+02
¹⁵¹ Sm	NL	4.6 E+01	2.1 E+05	7.06 E+04	1.76 E+03
¹⁵² Eu	NL	4.8 E-02	NL	1.74 E+04	4.35 E+02
¹⁵² Gd	NL	6.4 E-03	1.4 E+00	3.64 E+00	9.09 E-02
¹⁵³ Gd	NL	NL	NL	1.09 E+05	2.73 E+03
¹⁵⁴ Eu	NL	7.5 E-01	NL	1.32 E+04	3.30 E+02
¹⁵⁵ Eu	NL	NL	NL	6.67 E+04	1.67 E+03

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m ³)	Category 1 waste limit (Ci/m ³)	Category 3 waste limit (Ci/m ³)	ISB Non-combustible waste limit (Ci/m ³)	ISB Combustible waste limit (Ci/m ³)
¹⁷⁰ Tm	NL	NL	NL	1.38 E+05	3.46 E+03
¹⁷⁵ Hf	NL	NL	NL	6.52 E+05	1.63 E+04
¹⁸¹ Hf	NL	NL	NL	1.23 E+05	3.07 E+03
¹⁸² Ta	NL	NL	NL	8.00 E+04	2.00 E+03
¹⁸⁵ W	NL	NL	NL	4.62 E+06	1.15 E+05
¹⁸⁷ Re	3.3 E-02	3.6 E+01	7.8 E+03	6.32 E+07	1.58 E+06
¹⁹⁵ Au	NL	NL	NL	2.81 E+05	7.03 E+03
²⁰³ Hg	NL	NL	NL	5.00 E+05	1.25 E+04
²⁰⁴ Tl	NL	NL	NL	1.51 E+06	3.78 E+04
²⁰⁷ Bi	NL	1.7 E-03	1.44 E+03	1.82 E+05	4.54 E+03
²¹⁰ Pb	NL	3.7 E-02	2.1 E+06	1.82 E+02	4.55 E+00
²¹⁰ Po	NL	NL	NL	1.82 E+02	4.55 E+00
²²⁶ Ra	NL	1.7 E-04	4.3 E-02	4.44 E+02	1.11 E+01
²²⁷ Ac	NL	4.2 E-03	3.0 E+05	3.08 E-01	7.69 E-03
²²⁸ Ra	NL	1.7 E+01	NL	8.57 E+02	2.14 E+01
²²⁸ Th	NL	NL	NL	7.06 E+00	1.76 E-01
²²⁹ Th	NL	4.4 E-04	9.8 E-02	7.06 E-01	1.76 E-02
²³⁰ Th	NL	2.1 E-03	1.5 E-01	4.62 E+00	1.15 E-01
²³¹ Pa	NL	1.4 E-04	3.0 E-02	1.09 E+00	2.73 E-02
²³² Th	NL	1.1 E-04	2.3 E-02	8.57 E-01	2.14 E-02
Total U	1.4 E-05	NL	NL	NL	NL
²³² U	See Total U	4.6 E-04	4.6 E+00	5.45 E+00	1.36 E-01
²³³ U	See Total U	7.4 E-03	9.7 E-01	2.67 E+01	6.67 E-01
²³⁴ Th	NL	NL	NL	1.00 E+05	2.50 E+03
²³⁴ U	See Total U	8.9 E-03	1.9 E+00	2.73 E+01	6.82 E-01
²³⁵ U	See Total U	2.8 E-03	5.0 E-01	2.93 E+01	7.32 E-01
²³⁶ Pu	NL	NL	NL	1.40 E+01	3.49 E-01
²³⁶ U	See Total U	9.5 E-03	2.0 E+00	2.86 E+01	7.14 E-01
²³⁷ Np ^b	1.1 E-05	6.8 E-04	1.5 E-01	2.55 E+00	6.38 E-02
²³⁸ Pu ^b	NL	4.7 E-03	2.4 E+01	5.22 E+00	1.30 E-01
²³⁸ U	See Total U	5.7 E-03	1.2 E+00	3.08 E+01	7.69 E-01
²³⁹ Pu ^b	NL	1.9 E-03	4.2 E-01	4.62 E+00	1.15 E-01
²⁴⁰ Pu ^b	NL	1.9 E-03	4.3 E-01	4.62 E+00	1.15 E-01
²⁴¹ Am ^b	NL	2.1 E-03	8.5 E-01	4.44 E+00	1.11 E-01
²⁴¹ Pu	NL	6.1 E-02	2.5 E+01	2.35 E+02	5.88 E+00
^{242m} Am ^b	NL	1.9 E-03	1.6 E+00	4.62 E+00	1.15 E-01
²⁴² Cm	NL	NL	NL	2.03 E+02	5.08 E+00
²⁴² Pu ^b	NL	2.0 E-03	4.3 E-01	5.00 E+00	1.25 E-01
²⁴³ Am ^b	NL	1.0 E-03	2.3 E-01	4.44 E+00	1.11 E-01
²⁴³ Cm ^b	NL	1.8 E-02	3.4 E+02	6.67 E+00	1.67 E-01
²⁴⁴ Cm	NL	1.4 E-01	1.6 E+02	8.57 E+00	2.14 E-01
²⁴⁴ Pu ^b	NL	6.1 E-04	1.3 E-01	5.00 E+00	1.25 E-01
²⁴⁵ Cm ^b	NL	1.3 E-03	2.2 E-01	4.44 E+00	1.11 E-01
²⁴⁶ Cm ^b	NL	1.8 E-03	4.2 E-01	4.29 E+00	1.07 E-01
²⁴⁷ Bk ^b	NL	1.5 E-03	3.8 E-01	2.98 E+00	7.44 E-02
²⁴⁷ Cm ^b	NL	5.6 E-04	1.2 E-01	4.80 E+00	1.20 E-01

Table A-2. Low-Level Burial Grounds Radiological Content Limits

Isotope	Mobile radionuclide reporting limit (Ci/m ³)	Category 1 waste limit (Ci/m ³)	Category 3 waste limit (Ci/m ³)	ISB Non-combustible waste limit (Ci/m ³)	ISB Combustible waste limit (Ci/m ³)
²⁴⁸ Cm ^b	NL	5.1 E-04	1.1 E-01	1.21 E+00	3.03 E-02
²⁴⁹ Cf ^b	NL	7.8 E-04	3.6 E-01	2.96 E+00	7.41 E-02
²⁵⁰ Cf	NL	3.8 E-01	1.5 E+02	6.74 E+00	1.69 E-01
²⁵⁰ Cm ^b	NL	9.3 E-05	2.1 E-02	2.13 E-01	5.33 E-03
²⁵¹ Cf ^b	NL	1.3 E-03	3.8 E-01	2.91 E+00	7.26 E-02
²⁵² Cf	NL	NL	NL	1.43 E+01	3.57 E-01
²⁵⁴ Es	NL	NL	NL	5.22 E+01	1.30 E+00

Ci/m³ = curies per cubic meter.

NL means that there is no applicable limit for this isotope.

^a Limit for isotope in activated metal.

^b TRU isotope (half-life >20 years).

* Daughters with half-life less than 10 days and with parent radionuclide half-life greater than the daughter are not reportable.

Sources: WHC-EP-0645; WHC-SD-WM-TI-730; HNF-SD-WM-ISB-002.

APPENDIX B

FISSIONABLE MATERIAL CONTENT LIMITS

The following describes the limits for fissionable material content in waste packages or bulk waste sent to TSD units covered by criteria provided in Chapters 3.0 through 7.0 (CPS-D-149-00001, CPS-SW-149-00002, CPS-T-149-00025, CPS-SW-149-00003, WRP1-CPS-001). Fissionable material inventories for a given container shall be restricted to ensure they do not exceed the applicable fissionable material limit, including measurement uncertainty. For some waste packages, the generator must provide distribution of the fissionable material or moderating materials in the container to determine the applicable specification and whether criticality limits are met.

B.1. EXEMPT MATERIALS

Waste packages or bulk waste shipments are exempt from criticality safety controls and fissile labeling at all TSD units if the fissile gram equivalence for the contained fissionable material is less than 1 FGE. Natural uranium (i.e., 0.72 percent uranium-235) and depleted uranium (i.e., <0.72 percent) is always exempt for criticality purposes at the TSDs.

B.2. MEASUREMENT UNCERTAINTY FOR NONEXEMPT MATERIALS

Measured values of operating parameters subject to criticality safety limits (e.g., the mass of a given isotope) shall conservatively account for assessed biases and uncertainties for the measurement methods.

The measurement uncertainty will be accounted for in the following ways:

1. For TRU waste destined for WIPP, the sum of the measured mass and the mass corresponding to the 3 sigma total measurement uncertainty shall be less than the fissile material quantity limits in Table G-2.
2. For measurements of fissionable material under a critical mass limit, where the accuracy of the fissile mass measurement method is controlled to within ± 5 percent at the 95 percent confidence limit (CL), the reported mass may be used as the mass limit control value. If the method's accuracy is outside ± 5 percent (at the 95 percent CL), as it is for certain nondestructive assay (NDA) methods, then allowance for a potentially higher mass due to inaccuracy shall be accounted for in one of these ways:
 - The sum of the measured mass and the mass corresponding to the 2 sigma uncertainty in the measurement method shall be less than the criticality prevention specification (CPS) mass limit (i.e., the limits of this Appendix).
 - The WMP criticality safety representative shall give a written exemption to the requirement for considering the uncertainties in the measurement method at a given location, or for a given type of fissionable unit (HNF-7098). Such exemptions shall be obtained in accordance with Section 1.6 of these acceptance criteria.

B.3. NON-EXEMPT MATERIALS IN STANDARD CONTAINERS APPLICABLE TO LLBG, CWC, T-PLANT, AND WRAP

Certain non-exempt materials in standard packaging configurations (per table B-2) are acceptable at the LLBG (except greater than 1 percent enriched uranium in trenches 31 and 34), CWC, T-Plant, and WRAP. The fissionable material limits are expressed in ^{239}Pu FGE as defined in HNF-5134, *CSER 00-005, Determination of Fissile Gram Equivalence for Hanford Solid Waste Operations*, as stated in text, Section A.2. Table B-1 is used to determine the total fissile gram equivalence of fissionable material in a waste container by multiplying the gram quantity of each listed isotope by the correction factor and summing the results. Note that when waste contains a significant quantity of non-exempt ^{235}U , the FGE calculation will be conservative, as it does not account for the poisoning effect of ^{238}U in the mixture. If a container approaches or exceeds a limit of Table B-2 due in part to the ^{235}U content, the method provided in Section B.6 can be used to lower the contribution of ^{235}U to the total FGE.

Specific container limits are shown in Table B-2, which addresses the most common containers. Note that some of the limits in Table B-2 are based on WRAP authorization basis requirements and are slightly more restrictive than CWC and LLBG criticality limits. Higher quantities of fissionable nuclides could be allowed on a case-by-case basis for containers that are not suitable for processing at WRAP. Exceptions can be requested as specified in HNF-EP-0063 Section 1.6. If a new CSER is required for a new waste stream the generator will need to provide funding for performing the evaluation.

Note that for trenches 31 and 34, non-exempt quantities of uranium bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation.

Liquids and absorbed liquids with non-exempt quantities of fissionable material must be packaged in 1 gallon containers. (CPS-T-149-00025) Specific Plutonium Finishing Plant waste streams, however, are allowed for direct disposal into absorbent in 55-gallon drums with 90-mil liners at up to 200 FGE. (CPS-SW-006)

B.4. NON-EXEMPT MATERIALS IN NON-STANDARD CONTAINERS OR BULK WASTE APPLICABLE TO, LLBG, CWC, T-PLANT, AND WRAP

Waste packages that have non-exempt quantities of fissionable material but are not in Table B-2 standard containers (e.g., in 30-gallon drums, concrete or wood boxes, small boxes, ion exchange modules, or bulk waste shipments) may still be received for storage and disposal. Waste packages of this type may be arrayed together up to a maximum total of 119 FGE, corresponding to 22.5 percent of a minimum critical mass. 3-foot separation is required from other fissile material while in storage or for disposal. Other transportation limits might apply to the entire shipment. Note that for trenches 31 and 34, non-exempt quantities of uranium-bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation.

B.5. NON-EXEMPT QUANTITIES OF FISSIONABLE RADIONUCLIDES IN OTHER CONFIGURATIONS.

Limits for configurations other than those shown in Section B.3 and B.4 may be requested as described in HNF-EP-0063 Section 1.6. If a new CSER is required for a new waste stream the generator will need to provide funding for performing the evaluation.

B.6. CALCULATION OF URANIUM-235 FGE (²³⁵UFGE).

HNF-5134 provides a detailed method for calculating FGE that takes into account the poisoning effect of ²³⁸U. The maximum enrichment, or actual distribution if there is a mixture of enrichments, is required to perform this calculation. If uranium is not a significant factor, FGE may be calculated as shown in text, Section A.2. The ²³⁵U FGE value for the uranium in a waste package is calculated by one of the following methods.

1. FGE for ²³⁵U may be calculated using the conversion factor in Table B-1. ²³⁵U also may be excluded in calculating FGE if it is in natural or depleted uranium (less than or equal to 0.72 wt % ²³⁵U in U). The facility criticality safety representative may also exempt homogeneous uranium solutions in solid or liquid form up to 1.0 wt% enrichment of ²³⁵U in U.
2. The FGE for ²³⁵U may be conservatively calculated by including all ²³⁵U present with no exemptions on a 1 gram = 1 FGE basis. This conservative method of conversion is currently required for waste acceptance at the Waste Isolation Pilot Plant (WIPP).
3. If a bounding value or specific distribution is known for the ²³⁵U enrichment (e.g., based on analytical data or process knowledge), the facility criticality safety representative may use the alternate FGE method specified below. If the enrichment of a batch of uranium is not known, the enrichment value is treated as 100 % ²³⁵U and method 1 or 2, above, is used.

The first two methods above result in over counting the contribution of ²³⁵U to the fission process by neglecting the effects of ²³⁸U in reducing the neutron population available for fission (i.e., poisoning). These methods are adequate (safe) for accepting waste containers if the amount of ²³⁵U is less than the criticality mass limit, but such usage may unnecessarily restrict shipping of containers with greater than 1 g of ²³⁵U. Uranium FGE may be determined by summing the FGEs of ²³⁵U at each distinct homogeneous enrichment. Each FGE is the ratio of the uranium mass at an enrichment divided by the minimum critical mass at that enrichment from Table B-3, multiplied by the minimum critical mass for ²³⁹Pu (531 FGE). If the mass at each enrichment is not known or it is desirable to group several enrichments together, the highest enrichment is to be used for the entire mass of that group. The details of this calculation are specified below.

Calculate a fraction for each mass **A** (grams) of ²³⁵U with a distinct enrichment **B**, determine the ²³⁵U mass limit **D** for the enrichment **C** from Table B-3 which is greater than or equal to enrichment **B**. Calculate the sum-of-the-fractions using these fractions as follows:

$$\text{Uranium FGE} = \text{Sum of } (\mathbf{A} \div \mathbf{D}) \text{ for each distinct enrichment } (\mathbf{B}) \times 531$$

Table B-1. FGE Conversion Factors (FGE/gram)
Source: HNF-5134, Table 4-2

Isotope	Conversion factor	Isotope	Conversion factor
²³³ U	1.0e+0*	^{242m} Am	3.46e+1
²³⁵ U	6.43e-1	²⁴³ Am	1.29e-2
²³⁷ Np	1.5e-2	²⁴³ Cm	5.0e+0
²³⁸ Pu	1.13e-1	²⁴⁴ Cm	9.0e-2
²³⁹ Pu	1.0e+0	²⁴⁵ Cm	1.5e+1
²⁴⁰ Pu	2.25e-2	²⁴⁷ Cm	5.0e-1
²⁴¹ Pu	2.25e+0	²⁴⁹ Cf	4.5e+1
²⁴² Pu	7.5e-3	²⁵¹ Cf	9.0e+1
²⁴¹ Am	1.88e-2		

*Actual value for U233 is 9.0e-1, but normally taken as 1.

Table B-2. Fissionable Material Content Limits for Certain Standard Containers.

Container type	Fissionable material content ¹
208-liter (55-gallon) or larger steel drum, where fissile material is contained in 20% or more of the container volume	177 FGE ²
208-liter (55-gallon) or larger steel drum, where fissile material is contained in less than 20% of the container volume	100 FGE ²
208-liter (55-gallon) lead- or concrete-lined steel drum	100 FGE ²
208-liter (55-gallon) or larger drum with 90 mil liner and liquids in 3.8 liter (1 gallon) containers, or sorbed liquids in 1 gallon containers with sufficient sorbent material to sorb twice the liquid volume	100 FGE ²
DOT or NRC-Approved Containers (e.g., DOT Specification 6M)	Maximum fissile content may not exceed that which is acceptable for transportation as specified in the DOT regulations or the NRC Certificate of Compliance
Steel box containing flushed and drained equipment and/or HEPA filters -- all of the following limits shall apply:	<ul style="list-style-type: none"> • 325 FGE per piece of equipment • 353 FGE per cubic meter (10 FGE per cubic foot) on HEPA filters • 15 FGE in waste other than equipment or HEPA filters • 250 FGE total in box greater than or equal to 0.76 x 0.76 x 0.7 meters (2.5 x 2.5 x 2.5 feet) • 325 FGE total in box greater than or equal to 0.9 x 1.4 x 1.5 meters (3 x 4 x 5 feet)* • 1,000 FGE total in box greater than or equal to 1.2 x 1.2 x 2.1 meters (4 x 4 x 7 feet)

¹ Some of these limits are based on current WRAP acceptance requirements, which are more restrictive than CWC and LLBG criticality limits. Higher quantities of fissionable nuclides could be allowed on a case-by-case basis for containers that will not require processing at WRAP. Containers accepted for burial are limited to 119 FGE without a separate criticality evaluation.

² This limit assumes that the steel drum weighs a minimum of 23 kilograms (50.7 pounds) excluding the liner. Any drum that weighs less than 23 kilograms (50.7 pounds) requires overpacking or completion of a criticality safety evaluation.

Source: CPS-D-149-00001, CPS-SW-149-00002, CPS-SW-149-00003, CPS-T-149-00025, WRP1-CPS-001.

Table B-3. MCM and Maximum ^{235}U for Various Enrichments

Source: HNF-5134

(C) Maximum enrichment (wt% ^{235}U)	MCM for U (kg) (^{235}U plus ^{238}U) at this maximum enrichment	(D) Maximum ^{235}U (g) at this enrichment
0.72	Unlimited	Unlimited
0.80	10,000	80,000
0.85	7,000	60,000
0.90	3,800	35,000
0.95	2,600	25,000
1.00	2,000	20,000
1.15	889	10,222
1.25	627	7,836
1.50	375	5,628
1.70	270	4,590
1.80	231	4,160
2.00	180	3,606
2.50	109	2,730
3.00	78.0	2,340
3.50	62.1	2,172
4.0	48.9	1,956
4.5	40.8	1,830
5.0	34.8	1,740
8.0	17.5	1,404
10.0	13.0	1,300
20.0	5.52	1,104
30.0	3.33	1,000
40.0	2.376	951
50.0	1.835	918
75.0	1.116	837
100.0	0.819	819

Note that for trenches 31 and 34, non-exempt quantities of uranium bearing waste exceeding 1 percent enrichment can be accepted only with an approved criticality safety evaluation.

APPENDIX C

LABELING OF WASTE CONTAINERS

Containers sent to Hanford Site TSD units must be labeled for identification and to communicate information needed for proper waste management. Table C-1 shows the standard labeling required on containerized waste. The following sections provide general requirements for labels and markings:

C.1. BAR CODE

Each container shall be labeled with a bar code showing the unique container identification number (CIN#). Bar-coded CIN#s will be assigned as follows.

- For containers purchased through the Hanford Site procurement system, the bar code will be attached to the containers when the containers are received at the Central Stores warehouse. The CIN# is a unique seven-digit number beginning with the last two digits of the year the container was purchased.
- For containers not purchased through the Hanford Site procurement system, Hanford Site generators will assign a CIN#. The CIN# must be a unique number. The suggested format to ensure that the CIN# is unique is: "Facility ID - Year - Sequential#", where the Facility ID is the generating facility's unique 4-character (letter and/or number) identifier, "Year" is the last two digits of the year the CIN# was assigned, and "Sequential#" is generator's sequential numbering of containers for that year.
- For offsite generators, a bar code will be attached when the container is received on the Hanford Site. The CIN# will be the unique container identification number provided by the waste generator. (Note: offsite generators should contact the WMP acceptance organization for guidance on assigning a unique identification number).

C.2. DURABILITY

Labels and markings must be durable, fade-resistant, water-resistant paints, vinyl stickers, or another system that is sufficiently durable to remain intact and legible during management of the waste before disposal. For waste placed into storage, labels must remain intact and legible for 20 years.

C.3. PLACEMENT OF LABELS

Labels and markings shall be positioned so that all required information is visible on same side of the container as the bar code. If drums are destined for storage, the bolt on the drum ring must be placed at a 90-degree angle to the drum labels. If drums are palletized, the drums must be oriented on the pallet such that a complete set of labels is visible.

C.4. SIZE OF LABELS

Standard labels defined by regulations (e.g., DOT labels, hazardous waste label, PCB label, asbestos label) should be the conventional size specified by the regulations. Characters on other labels (e.g., gross weight, major risk label), must be a minimum of 2.54 centimeters (1 inch) high.

C.5. LABELING INNER CONTAINERS IN LAB PACKS

Each inner container in a lab pack must be labeled with an identification number or waste name cross-referenced against the contents inventory sheet. These labels must be sufficiently durable to remain legible for 20 years.

Table C-1. Required Labeling for Waste Containers.

Label	When required	Location on drum	Location on box
Bar Code with CIN#	All containers	Bottom third of drum	Short side of box
Gross weight in kilograms (Kg units must appear on label)	All containers	Same side as bar code	Same side as bar code
Applicable DOT labeling	All containers	As specified in 49 CFR	As specified in 49 CFR
Hazardous waste label	Mixed waste containers	Same side as bar code	Same side as bar code
Major risk label(s) ¹	Mixed waste containers	Same side as bar code	Same side as bar code
PCB label ²	Waste that is regulated for PCB content under 40 CFR 761	Same side as bar code	Same side as bar code
Asbestos label	As required per 40 CFR 61 Subpart M	Same side as bar code	Same side as bar code
Fissile bar code label and fissile gram label ³	Containers with 1 FGE or more fissionable material	Same side as bar code	Same side as bar code

¹ Refer to Table C-2 for major risk labeling of mixed and TRU-mixed waste.

² Label in accordance with 40 CFR 761.40. The label placed on containers holding PCB items must include the date the item was removed from service. For PCB articles and containers, the label must include the date the waste was placed into storage, including 30-day temporary storage areas.

³ These labels might conflict with DOT Fissile label; for shipments of waste from offsite, these labels should be placed on the containers at the time the waste arrives on the Hanford Site.

Table C-2. Selection of Major Risk Labeling.

Hazard or risk	Acceptable labels and markings
Flammable liquid	DOT Class 3 label (Flammable Liquid) FLAMMABLE LIQUID COMBUSTIBLE LIQUID
Flammable solid	DOT Division 4.1 label (Flammable Solid) FLAMMABLE SOLID
Water-reactive	DOT Division 4.3 label (Dangerous When Wet) WATER-REACTIVE
Oxidizer	DOT Division 5.1 label (Oxidizer) OXIDIZER
Reactive organic peroxide	DOT Division 5.2 label (Organic Peroxide) REACTIVE - ORGANIC PEROXIDE
Poison	DOT Division 6.1 label (Poison) DOT "Poison - Inhalation Hazard" marking
Corrosive	DOT Class 8 label (Corrosive) CORROSIVE – ACID CORROSIVE – CAUSTIC CORROSIVE
Toxic (this hazard refers to DOT Class 9 waste that is derived from listed waste and/or toxicity characteristic waste.)	DOT Class 9 label (Miscellaneous) and TOXIC marking

Note: Choose the combination of labels or markings that most clearly communicates the major risk(s) associated with the waste. Markings in Table C-2 must be applied for dangerous waste major risk(s) regardless of the DOT radioactive labeling status. DOT labels must be used when required by DOT; other markings can be used to communicate hazards for which DOT labels are not to be applied [e.g., if a container has waste that is an oxidizer and toxic and the 49 CFR regulations prescribe that only the 5.1 (Oxidizer) label be applied, the container should be labeled with the DOT 5.1 label and with an additional marking with the word TOXIC]. If a given risk label conflicts with DOT transportation requirements, the label can be provided with the paperwork to be applied when the container reaches the TSD unit.

For Washington state-only dangerous waste, the words “hazardous waste” or “dangerous waste” on the hazardous waste label are sufficient to communicate the major risk (HNF-PRO-455).

APPENDIX D

SELECTION OF COMPATIBLE CONTAINERS, COATINGS, AND LINERS

WAC 173-303-630 (4) requires that containers used for storage of dangerous waste be made of or lined with materials that are compatible with the waste and will not react with the waste such that the ability of the container to contain the waste is not impaired. A variety of factors affect the compatibility of a container/liner combination, including the properties of chemical constituents in the waste, the physical form of the waste (e.g., free liquid, sorbed liquid, dry waste), and the anticipated length of storage.

The generator must determine the compatibility of the container/liner and the waste based on chemical compatibility charts, manufacturer's compatibility data, and/or other applicable data. Any combination of containers and/or liners can be used that is compatible with the waste.

Hanford Site procurement specifications for metal drums (HNF-7403) and boxes (WHC-S-0456) identify several options for container coatings, with varying degrees of chemical resistance. The document *Justification for Packaging Acceptance Criteria* (WHC-SD-TP-ES-002) describes a set of standard packages from the Hanford site that generally will be compatible with the types of waste generated on the Hanford Site. Table D-1 provides baseline coating and liner combinations for metal containers based on WHC-SD-TP-ES-002. These container/liner combinations generally provide a compatible container, although compatibility data must demonstrate that the container is compatible with the waste. (Note: the Hanford Site specifications and Table D-1 are provided for information purposes only. Packaging is not required to be selected from Hanford Site specifications.)

Table D-1. Standard Container/Liner Combinations.

WSRd Series	Subgroup ¹	Minimum Coatings/Liners ²
100 – Low-level waste	Low-level dry waste for disposal	LPC / no liner
	Low-level absorbed liquids	LPC/10 mil liner
200 – TRU waste	Dry debris and soil	LPC / 10 mil liner MPC/ no liner
	Sorbed or solidified corrosive (acid or caustic) liquids	LPC / 90 mil liner HPC / no liner
	Sorbed or solidified noncorrosive liquids, sludges, and wet soil	MPC / 10 mil liner LPC / 90 mil liner
400 – Mixed waste overpacked and lab packed liquids	Organic liquids (noncorrosive)	MPC / 10 mil liner LPC / 90 mil liner
	Corrosive (acidic or caustic) or oxidizing liquids	HPC / no liner LPC / 90 mil liner
	Other noncorrosive waste	MPC / 10 mil liner LPC / 90 mil liner
500 – Mixed waste solids, sorbed liquids, and soils	Sorbed organic liquids or sludges (noncorrosive)	MPC / 10 mil liner LPC / 90 mil liner
	Corrosive (acidic or caustic) or oxidizing waste	HPC / no liner LPC / 90 mil liner
	Noncorrosive sorbed liquid, sludges, or wet soils	MPC / 10 mil liner LPC / 90 mil liner
	Noncorrosive dry solids or dry soils	MPC / no liner LPC / 10 mil liner
600 – Mixed debris waste	Corrosive (acidic or caustic) or oxidizing debris	HPC / no liner LPC / 90 mil liner
	Other noncorrosive debris	MPC / no liner LPC / 10 mil liner
800 – Mixed waste with specific treatment standards	Lead solids, beryllium powder	LPC / no liner
	Elemental mercury	LPC / 10 mil liner
	Batteries containing acids or caustics	HPC / no liner LPC / 90 mil liner
	Other	Case-by-case evaluation
900 – State-only mixed waste and LDR-compliant mixed waste	Solid corrosive waste	HPC / no liner LPC / 90 mil liner
	Other	MPC / no liner LPC / 10 mil liner

¹ For mixed hazards, the most protective combination of coatings/liners should be chosen.

² Container coating/liner abbreviations are as follows:

10 mil liner- 10 mil or thicker nylon-reinforced polyethylene liner

90 mil liner- 90 mil or thicker high-density polyethylene rigid liner.

APPENDIX E

SELECTION AND USE OF VOID FILLERS, SORBENTS AND STABILIZING MATERIALS

A variety of materials can be added as void filler to meet the void space requirements of text Chapters 3.0 and 4.0. Approved void fillers are listed in the Approved Sorbents/Stabilizing Materials List on the *Hanford Site Solid Waste Acceptance Program* Internet web page (<http://www.hanford.gov/wastemgt/wac/index.htm>).

Sorbents and stabilizing materials can be used to meet free liquid requirements or to provide a safer waste form for handling and storage. All sorbents and stabilizing materials must be nonhazardous, compatible with the waste being sorbed or stabilized, and nonbiodegradable as defined in 40 CFR 264.314(e). Table E-1 lists the general types of sorbents and stabilizing materials that can be used for major Hanford Site waste streams. Specific products must be from the Approved Sorbents/Stabilizing Materials List on the *Hanford Site Solid Waste Acceptance Program* Internet web page (<http://www.hanford.gov/wastemgt/wac/index.htm>) or other products meeting the definitions of Section E.1 that have been listed on an approved Waste Profile Sheet. A generator or vendor can provide information to the WMP acceptance organization to have a product added to the Approved Sorbents/Stabilizing Materials List.

Note that use of these materials to meet radiological stabilization (i.e., to meet Category 3 or mobile radionuclide stabilization requirements) or RCRA LDR treatment standards is not addressed in this appendix. More specific evaluation must be performed as specified previously in this document to demonstrate radiological stabilization or LDR compliance.

E.1. GENERAL TYPES OF SORBENTS AND STABILIZING MATERIALS POTENTIALLY ALLOWED

The general types of sorbents and stabilizing materials potentially allowed include the following:

Note- Selection of specific materials must follow Section E.2

- Inorganic mineral sorbents including aluminosilicates, clays, vermiculite, zeolites, lime, silica, diatomaceous earth, perlite, and fly ash and other inorganic materials used for absorption.
- High molecular weight synthetic polymers (polymer sorbents) including polyethylene, HDPE, polypropylene, polyacrylate, and other synthetic polymers. This excludes polymers derived from biological material (e.g., cellulose-based materials), and polymers specifically designed to be degradable.
- Stabilizing materials including concrete, portland cement, lime/pozzolans, and a variety of other inorganic materials.
- Specialty stabilization agents for organic liquids including certain products that stabilize organic liquids. These products chemically react with organic liquids to prevent their release in the disposal environment.

E.2. SELECTION AND USE OF SORBENTS AND STABILIZING MATERIALS

Selection and use of a specific product for sorption of a given waste must address the following.

- Determine from Table E-1 what general classes of materials can be used and the conditions for use. The allowable types of sorbents for various waste streams are based on the anticipated treatment/disposal methods.
- Select a product that is appropriate for the material to be treated. The Approved Sorbents/Stabilizing Materials List on *the Hanford Site Solid Waste Acceptance Program* Internet web page (<http://www.hanford.gov/wastemgt/wac/index.htm>) has a current list of approved sorbents and stabilizing materials. Alternatively, generators can request approval of other products in the waste stream profile sheet by providing data to support the intended use. Approval of the profile will constitute approval of the product.
- Obtain manufacturer's instructions and limitations for use of the product. It is critical to use sorbents and stabilizing materials in accordance with the manufacturer's instructions. Information required includes the following:
 - Compatibility of the sorbent or stabilizing material with the waste
 - The recommended ratio of sorbent to waste for the liquid being sorbed.
 - For stabilizing materials, the exact ratio of liquid to stabilizing materials and methods of mixing.

It might be necessary to run a test of the waste or a surrogate to ensure that the product works adequately with the waste requiring sorption or stabilization.

E.3. HANFORD SITE REQUIREMENTS FOR USE OF SORBENTS

Sorbents used for Hanford Site TSD units must be used in sufficient quantity to meet the following requirement.

- Use twice the minimum amount of sorbent. Based on data from the manufacturer or testing, the minimum ratio of sorbent to liquid is determined. For all Hanford Site applications, a minimum of twice the minimum amount of sorbent shall be used.

Table E-1. Sorbent Selection Based on Waste Specification Records.

WSRd Series	Subgroup	Allowable sorbents/stabilizing materials	Use requirements
100 - Low-level waste	Low-level liquids for disposal	Mineral sorbents Polymer sorbents Stabilizing materials	
	Low-level organic liquids and chelating agents for disposal	Stabilizing materials	
200 - TRU waste	TRU-mixed waste	Mineral sorbents Polymer sorbents Stabilizing materials	
	TRU waste (not mixed)	Mineral sorbents Polymer sorbents Stabilizing materials	
400 - Mixed waste overpacked and lab packed liquids ²	All types	Polymer sorbents	
500 - Mixed waste solids, sorbed liquids and soils	Non-thermal treatment WSRds (520 series)	Mineral sorbents	
	Thermal treatment WSRds (500 series)	Polymer sorbents	
600 – Mixed debris waste	Thermal treatment WSRds (620 series)	Polymer sorbents	
	Non-thermal treatment WSRds (640 series)	Mineral sorbents	
800 – Other mixed waste with specific treatment standards	All types	Polymer sorbents	
900 – State-only mixed waste and LDR compliant mixed waste	Thermal treatment WSRds (920 series)	Polymer sorbents	
	Other WSRds	Mineral sorbents Stabilizing materials	

^{1 2} Sorbent for lab packs is placed around containers, not mixed with liquids.

APPENDIX F

RELEASE OF NONRADIOACTIVE WASTE FOR OFFSITE DISPOSAL

This appendix establishes the method for radiological release of waste generated by PHMC waste generators. The method is intended primarily for release of dangerous waste, TSCA PCB waste, and nonregulated waste to offsite TSD facilities, but also could be used for waste that is not a regulated dangerous waste or TSCA PCB waste shipped to RCRA Subtitle D facilities. (RMIS Accession Numbers D195034916, D196016603, D196055119, D196062490)

F.1. DEFINITIONS

The following definitions and abbreviations apply specifically to this appendix.

No radiation added: Any waste material that:

- Contains no measurable increase in bulk or volume radioactivity (at a 95 percent confidence level above background) resulting from DOE Operations except for waste specifically exempted by EPA, DOE, or NRC regulations
- Contains no surface radioactivity above limits established in the HNF-5173.

No potential for internal contamination (NPIC) waste: A waste generated in a listed Radioactive Material Area (RMA), but for which there is no potential for volumetric contamination. NPIC waste can be:

- In a form that could not be internally contaminated (aerosol cans, sealed containers, fluorescent light tubes, etc.)
- Known through process knowledge that there is no potential for the waste to be volume contaminated.

NPIC waste must meet the surface contamination release requirements of HNF-5173.

Naturally occurring radioactive material (NORM) waste: A NORM waste is a waste for which the only radioactive component is a naturally occurring isotope. An example of a NORM waste is water with potassium chloride (containing a percentage of ^{40}K).

Other matrix: Waste comprised of any materials not meeting the definitions of water or soil matrices.

Process knowledge: Specific knowledge on the origin, storage, use, and potential exposure of a waste to radiological contamination. Process knowledge is used to determine if a waste has the potential to be radiologically contaminated. If the waste has the potential to be radiologically contaminated, process knowledge is used to identify the radionuclides of concern. Process knowledge must be formally certified by the waste generator. If a generator does not have process knowledge of a waste stream, the waste will be managed as if it is potentially both internally and externally contaminated.

Radioactive materials area: RMA is an area in which the potential exists for contamination because of the presence of unencapsulated or unconfined radioactive material or an area that is exposed to beams or other sources of particles (neutrons, protons, etc.) capable of causing activation.

Radioactive waste: Any waste managed or regulated for its radioactive content.

Soil matrix: Waste comprised of soil or earthen materials.

Volumetric contamination: Radiological contamination that is distributed throughout a solid or liquid matrix, as opposed to surface contamination.

Water matrix: Waste comprised primarily of water that could be contaminated with organic or inorganic contaminants that do not interfere with obtaining the lower limits of detection (LLDs) for the water matrix listed in Table F-2.

F.2. RADIOLOGICAL RELEASE PROCEDURE

This section defines the method by which a generator determines that no radiation was added to the waste. The generator follows each step in succession until a determination is made that the waste can be released as nonradioactive or that the waste must be managed as a radioactive waste. The procedure follows the decision tree illustrated on Figure F-1.

1. When a waste is identified that requires disposal, the generator determines through process knowledge whether the waste was generated or stored in an RMA. If the waste was not generated/stored in an RMA, the generator proceeds to Step 2. If the waste was generated or stored in an RMA, or if the generator does not believe that process knowledge is adequate, the generator proceeds to Step 3.
2. The generator completes the Radiological Release Certification for Waste form, Figure F-1, checking the box corresponding to the 'Non-RMA Waste Certification', and proceeds to step 12.
3. The generator determines whether the RMA waste has no potential for internal contamination (NPIC). An RMA waste qualifies as NPIC if the waste is in a form that could not be internally contaminated (e.g., aerosol cans, sealed containers, fluorescent light tubes), or if, through process knowledge, it is known that there is no potential for the waste to be volumetrically contaminated. If the waste has no potential for internal contamination, the generator proceeds to Step 4. If the waste does not qualify as NPIC, the generator proceeds to Step 8.
4. To be released, NPIC waste must meet the surface contamination release requirements of HNF-5173. If there is no surface contamination, the generator proceeds to Step 7. If there is surface contamination, the generator proceeds to Step 5.
5. If the container holding a NPIC waste has surface contamination, the generator attempts to decontaminate the exterior of the container. If decontamination is possible, the generator proceeds to Step 7. If decontamination is not possible, the generator proceeds to Step 6.
6. If the NPIC waste can be transferred from the contaminated exterior container into another container without contaminating the NPIC waste, the waste is transferred and the generator proceeds to Step 7. If it is not possible to repackage without potentially contaminating the NPIC waste, the waste transferred out of its contaminated packaging and the generator proceeds to Step 8.
7. The generator completes the Radiological Release Certification for Waste form, Figure F-2, checking the box corresponding to the 'NPIC Waste Certification', and proceeds to Step 12.

8. When a potential for radioactive contamination of the waste exists, which cannot adequately be resolved by process knowledge, certification of the absence of radioactive material is based on radiological survey, sampling, and analytical data. The generator, following SW-846 methods, obtains a representative sample of the waste. Samples of compatible waste having the same radiological process knowledge can be composited for more cost-efficient analysis.

Radionuclide analysis is performed using the appropriate methods, selected from Table F-1, to measure the radionuclides of concern identified from process knowledge. Gross methods (e.g., gross alpha, gross beta, total uranium) from Table F-1 can be used as long as the method is capable of detecting all nuclides in the waste at or below the LLDs in Table F-2. Alternate radioanalytical methods having LLDs equal to or less than those listed in Table F-2 could be used.

Analytical results less than or equal to the LLD listed in Table F-2 for the isotopes of concern will demonstrate that no radioactivity has been added. If a gross analytical method is used, the analytical result must be less than or equal to the lowest LLD among the radionuclides of concern measured by that method. If the analytical results meet the Table F-2 limits, the generator performs an external survey to release the container and proceeds to Step 9.

If the measurements are greater than the Table F-2 limits, the generator could proceed to Step 10 (optional), or could proceed directly to Step 13.

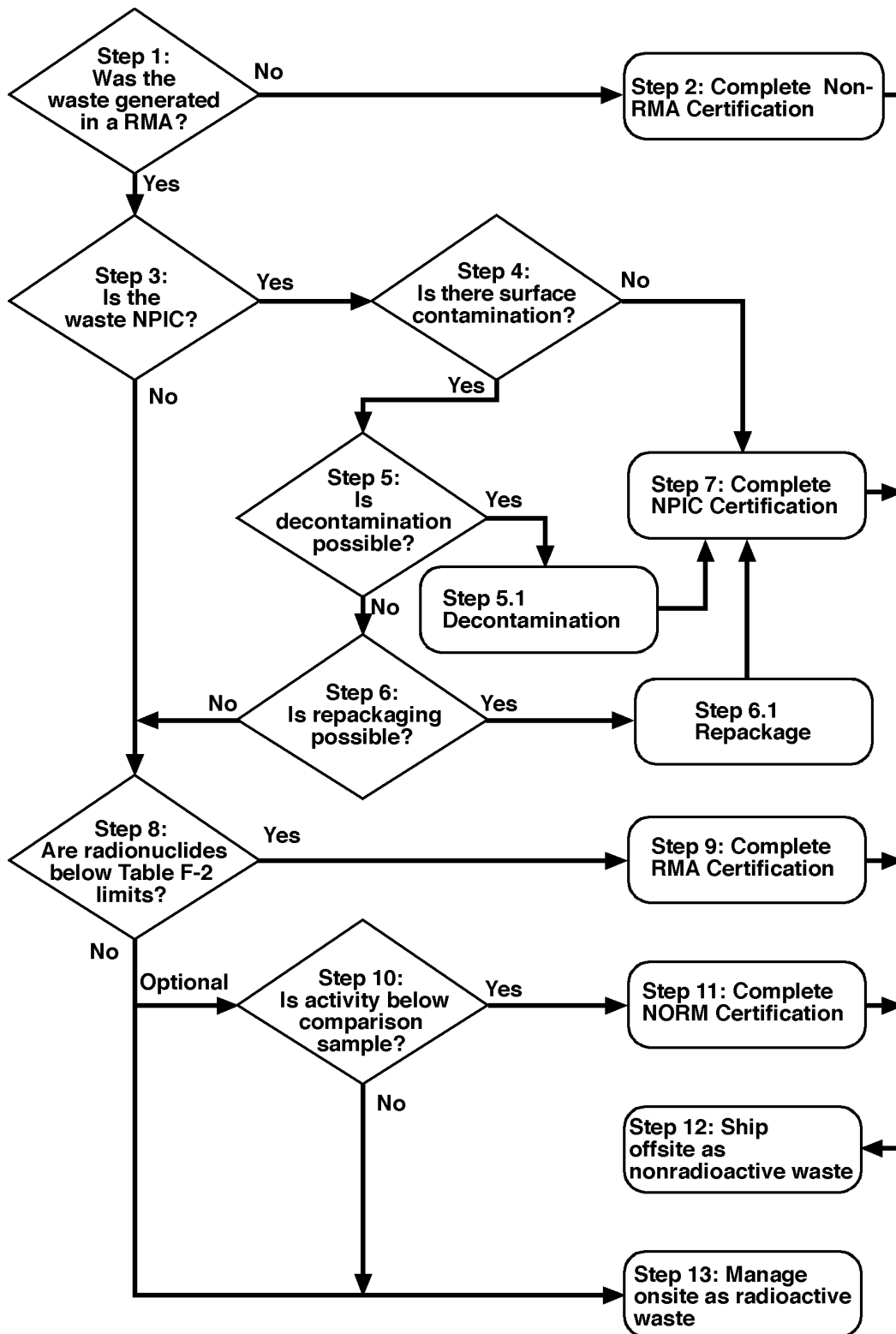
9. The generator completes the Radiological Release Certification for Waste form, Figure F-2, checking the box corresponding to the 'RMA Waste Certification', and proceeds to Step 12.
10. This step provides the option to demonstrate that radiological contamination exceeding LLDs (Step 8) is due to NORM.

A comparison sample is prepared using virgin (non-RMA) materials in the same concentrations as the waste and analyzed by the same radioanalytical method as the sample in Step 9. If the concentration of radionuclides in the waste is less than or equal to the concentration in the virgin sample, the waste will be considered NORM waste. The generator performs an external survey to release the container and proceeds to step 11.

If the waste stream does not meet this criterion, the generator proceeds to Step 13.

It should be noted that because of the complexity of some waste streams, performing comparison sample analysis to release the waste might not be possible.

11. The generator completes 'Radiological Release Certification for Waste' form, Figure F-2, checking the box corresponding to the 'NORM Waste Certification', and proceeds to Step 12.
12. The waste is shipped to the offsite facility. The completed Radiological Release Certification for Waste is maintained in the generator's files.
13. If none of these release methods are successful, the waste is designated and managed as radioactive waste.



RMA radioactive material area
 NPIC no potential for internal contamination
 NORM naturally occurring radioactive material

H00060047.1

Figure 1. Decision Tree for Radiological Release.

Radiological Release Certification Form

Package identification number(s): _____

Check the applicable box or boxes:

☐ Non-RMA Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was not generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). The waste's container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual.

☐ NPIC Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material. It is additionally certified that while the waste was in this area, the waste was in a form or location which could not be internally contaminated (aerosol cans, sealed containers, fluorescent light tubes, etc.). The waste's exterior and/or container have met all of the external radiation release requirements of the Hanford Site Radiological Control Manual.

☐ RMA Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). It is additionally certified that all of the activity levels for the radionuclides of concern are less than the LLD's specified in Table F-2. The waste container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual. A copy of the laboratory analytical data is attached.

☐ NORM Waste Certification

The undersigned certifies that, to the best of his/her knowledge, the waste identified above was generated or stored in an area where there is a potential for contamination because of the presence of unencapsulated or unconfined radioactive material, or, an area that is exposed to beams or particles capable of causing activation (neutrons, protons, etc.). It is additionally certified that all of the activity levels for the NORM constituents in the waste were less than or equal to the activity levels in a virgin comparison sample of NORM waste. The waste container has met all of the external radiation release requirements of the Hanford Site Radiological Control Manual. A copy of the laboratory analytical data for both the waste sample and the comparison sample are attached.

Describe process knowledge leading to the classification chosen above:

List the radionuclides potentially present in the waste and describe why these are the only radionuclides of concern (applicable only to RMA and NORM certifications):

Radiological release survey number(s) (applicable to NPIC, RMA, and NORM certifications):

Certification:

Name (print) _____ Signature _____ Date _____

Title _____ Company _____

Figure 2. Radiological Release Certification for Waste.

Table F-1. Radioanalysis Techniques Used for Release.

Matrix	Analysis group	Technique
water	Gross alpha/beta activity	proportional counting liquid scintillation
	Gamma emitters	gamma energy analysis
	Beta specific emitters	proportional counting ¹ liquid scintillation ¹ low energy photon spec. (I-129) ¹
	Radium alpha emitters	alpha scintillation ¹ proportional counting ¹
	Specific actinide emitters	alpha energy analysis ¹ laser kinetic phpos. (U chem) ¹
soil/other	Gross alpha/beta activity ²	proportional counting liquid scintillation
	Gamma emitters	gamma energy analysis
	Beta specific emitters ²	proportional counting ¹ liquid scintillation ¹ low energy photon spec. (I-129) ¹
	Radium alpha emitters ²	alpha scintillation ¹ proportional counting ¹
	Specific actinide emitters ²	alpha energy analysis ¹ laser kinetic phpos. (U chem) ¹

¹ Specific radionuclide analysis requiring chemical separation procedure processing.

² Soil/other matrix samples requiring chemical dissolution before chemical separation/counting.

Table F-2. Required Lower Limits of Detection for Radionuclides.

Analysis/isotope		Water matrix		Soil or other matrix	
		Limit	Units	Limit	Units
Gross alpha		3 ^a	pCi/L	5 ^a	pCi/g
Gross beta		4 ^b	pCi/L	10 ^b	pCi/g
Gamma emitters (GEA)	Co-60	50		10	pCi/g
	Cs-137	50		10	
	Eu-152	50		10	
	Eu-154	50		10	
	Eu-155	50		10	
	Ra-226	NA		2	
	Ra-228	NA		2	
	Na-22	50		10	
	Na-24	50		10	
Report any detectable isotope					
Specific beta emitters					
Tritium		400	pCi/L	400	pCi/g
C-14		200	pCi/L	50	pCi/g
Ni-59		30	pCi/L	30	pCi/g
Ni-63		30	pCi/L	30	pCi/g
Se-79		Refer to footnote c		Refer to footnote c	
Sr-89		5	pCi/L	10	pCi/g
Sr-90		2	pCi/L	10	pCi/g
Tc-99		30	pCi/L	30	pCi/g
I-129		25	pCi/L	25	pCi/g
Ra-228 (via Ac-228 daughter)		3	pCi/L	GEA	pCi/g
Radium alpha emitters					
Ra-226 (via Rn -222 daughter)		2	pCi/L	GEA	pCi/g
Gross Radium		2	pCi/L	5	pCi/g
Specific actinides					
Isotopic thorium (Th -228, 230, 232)		2 ^d	pCi/L	2 ^d	pCi/g
Isotopic uranium (U-234, 235, 238)		2 ^d	pCi/L	2 ^d	pCi/g
Total uranium (Chemical Analysis)		0.2	ug/L	2	ug/g
Np-237		2	pCi/L	2	pCi/g
Pu-238		2	pCi/L	2	pCi/g
Pu-239/240 (sum)		2		2	
Pu-241		20		20	
Am-241		2	pCi/L	2	pCi/g
Cm-244		2	pCi/L	2	pCi/g

^a Applies only if the absence of alpha emitting radionuclides with lower LLDs is known.

^b Applies only if the absence of beta emitting radionuclides with lower LLDs is known.

^c If fission products (e.g., Cs-137 and Sr-90) are below their LLD values the Se-79 will also be below detectable limits.

^d Signifies 2 pCi/L (or 2 pCi/g respectively) for each isotope. It should be noted that the analysis will not differentiate between some isotopes (i.e., analysis will not differentiate between U-235 and U-236).

LLD = lower limit of detection; pCi/L = picocuries per liter; pCi/g = picocuries per gram; ug/L = microgram per liter.

APPENDIX G

TRANSURANIC WASTE CERTIFICATION REQUIREMENTS

As a generator of transuranic (TRU) and TRU mixed waste destined for disposal at the Waste Isolation Pilot Plant (WIPP), the Hanford Site must ensure that its Contact Handled (CH) TRU waste meets the requirements of U.S. Department of Energy (DOE) Order 435.1, "Radioactive Waste Management," and the DOE/WIPP-02-3122, "*Contact-Handled Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*"- (WIPP WAC). The WIPP WAC establishes the specific physical, chemical, radiological, and packaging criteria for acceptance of defense TRU waste shipments at WIPP as required depending upon waste material form and packaging configurations.

In addition to meeting the general requirements of HNF-EP-0063, the following are the specific TRU waste acceptance criteria.

RH-TRU Criteria:

WIPP is currently unable to accept remote-handled (RH) TRU waste, hence, RH-TRU waste currently has no path to disposal. Acceptance of RH-TRU by Hanford TSDs is therefore evaluated on a case-by case basis. Requirements for RH-TRU acceptance are established as part of the waste stream profile approval and will not be identified in this document. Generators are strongly encouraged to package RH-TRU waste in 55-gallon drums and obtain waste stream profile approval prior to packaging the waste. Please note that RH-TRU is defined as packaged TRU with unshielded external surface dose rate exceeding 200 millirem/hour at contact.

CH-TRU Criteria:

1. Waste must be segregated by WSRd, including segregation of defense from non-defense waste. Non-defense waste is prohibited.

Defense waste is waste generated by activities of the Secretary of Energy (and predecessor agencies) performed in whole or in part in carrying out any of the following functions: naval reactors development; weapons activities, including defense inertial confinement fusion; verification and control technology; defense nuclear material production; defense nuclear waste and materials by-product management; defense nuclear materials security investigations; and defense research and development.

2. Waste must meet all requirements in Tables G-1 through G-6 except as allowed with profile sheet approval.
3. Newly generated waste may require packaging using the visual examination (VE) technique. This requirement, if applicable, will be communicated to the generator as a waste stream profile condition of approval.
4. NDA – Newly generated waste may require that the WMP WIPP Certification Program certify the NDA equipment used to quantify the radiological properties. This requirement, if applicable, will be communicated to the generator as a waste stream profile condition of approval.
5. Acceptable Knowledge (AK) data must be provided through use of a waste stream profile sheet from

the Hanford Site Solid Waste Acceptance Program webpage. The profile sheet is located at <http://www.hanford.gov/wastemgt/wac/index.htm>.

Generators unable to meet the above CH-TRU criteria may request an exception to the waste acceptance criteria per Section 1.6 of HNF-EP-0063.

Table G-1. Container Properties.

Waste Attributes	Waste Acceptance Criteria	Compliance Methods
Payload container description	U.S. Department of Transportation (DOT) Type A or equivalent <ul style="list-style-type: none"> 55-gallon drums (direct fill or containing a pipe component) 55-gallon drums are < 24 inches in diameter (including gasket, locking ring, and torqued accordingly) and < 34 - 15/16 inches tall (fully assembled) SWBs (standard waste box) TDOPs (ten-drum overpack) 85-gallon drum overpacking a 55-gallon drum (no direct fill) 	Site procurement specifications and QA acceptance reports, or manufacturer's fabrication documentation and records demonstrating equivalency with DOT Type A requirements, or testing records showing compliance with 49 CFR 173.461, or comparison to technical criteria/industry standards. Pipe overpack containers, SWB's, and TDOP's specifications procured consistent with TRUPACT II SARP requirements. Visual inspection to verify container integrity.
Container weight and center of gravity	<ul style="list-style-type: none"> DOT Type A or equivalent limits 	Records of loaded container/assembly weights. (Weighing individual containers and totaling is acceptable.)
Removable surface contamination	For individual containers and payload assemblies: <ul style="list-style-type: none"> ≤ 20 dpm/100 cm² for alpha ≤ 200 dpm/100 cm² for beta-gamma The fixing of surface contamination to meet these limits is not allowed.	Records of surface contamination surveys taken on individual containers prior to release from a radiological contamination area.
Container identification and marking	<ul style="list-style-type: none"> Bar code label consisting of a unique container identification number Shipping category 	Visual inspection at time of shipment.
Confinement Requirements	<ul style="list-style-type: none"> Maximum layers of confinement allowed is 6, including the liner. Smaller number of confinement layer may be required as a waste stream profile condition of approval. Newly generated waste must be packaged with filtered bags or be horsetailed. Filtered bags are considered layers of confinement. 	Contents inventory records which clearly indicate the number of confinement layers.
Filter vents	Payload containers vented using 1 or more filter(s) that meet the WIPP Hazardous Waste Facility Permit and the TRUPACT-II SARP, Appendix 1.3.5 specification Drums with vent clips are not considered vented.	Site procurement specifications and QA acceptance reports, manufacturer's fabrication documentation, and records of visual inspection.

Table G-2. Radiological Properties.

Waste Attributes	Waste Acceptance Criteria	Compliance Methods
Radionuclide composition	<ul style="list-style-type: none"> Assay measurements Quantification of ^{241}Am, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{233}U, ^{234}U, ^{238}U, ^{90}Sr, and ^{137}Cs 	Records of assay data and acceptable knowledge (AK) documentation
Fissile material quantity (^{239}Pu fissile gram equivalent [FGE])	<ul style="list-style-type: none"> ≤ 200 g/55-gallon drum (direct fill or containing a pipe component) ≤ 325 g/SWB ≤ 325 g/TDOP Note that uncertainty must be accounted for in accordance with Appendix B, Section B.2 	Records of assay data and AK documentation and calculations using isotopic composition, specific activity of the isotopes, and measured assay values to calculate ^{239}Pu FGE.
TRU alpha activity concentration	> 100 nCi of alpha-emitting TRU isotopes per gram of waste	Records of assay data and AK documentation and records of calculations showing concentrations of the total TRU radionuclides in the waste matrix.
^{239}Pu equivalent activity (PE-Ci)	<p><u>Untreated waste:</u></p> <ul style="list-style-type: none"> ≤ 80 PE-Ci/55-gallon drum ≤ 130 PE-Ci/SWB ≤ 130 PE-Ci/TDOP ≤ 1100 PE-Ci/55-gallon drum overpacked in SWB or TDOP or 85 gallon drum ≤ 1100 PE-Ci/SWB overpacked in TDOP ≤ 1800 PE-Ci/55-gallon drum containing a pipe component <p><u>Solidified/vitrified waste:</u></p> <ul style="list-style-type: none"> ≤ 1800 PE-Ci/55-gallon drum 	Records of assay data and AK documentation and records of conversion and calculations using Appendix B of the WIPP WAC
Radiation dose rate	<ul style="list-style-type: none"> ≤ 200 mrem/hr at the surface of the payload (waste) container and the TRUPACT-II ≤ 10 mrem/hr at 2 meters 	Measurements shall be made on each CH-TRU waste container with instruments calibrated using sources traceable to a national standard. Internal payload container shielding cannot be used to meet dose rate requirements except for the approved pipe component configuration.

Table G-3. Physical Properties.

Waste Attributes	Waste Acceptance Criteria	Compliance Methods
Liquids	<p>Liquid waste is prohibited in payload containers except for residual amounts as follows:</p> <p><u>Free liquid:</u></p> <ul style="list-style-type: none"> • < 1 volume percent of external container • < 1 inch or 2.5 cm in bottom of internal containers <p><u>Liquid identification:</u></p> <ul style="list-style-type: none"> • Generators must specify the quantity and location of all liquids in the container. 	<p>AK, radiography, visual examination, and/or packaging records will be used to determine the presence of free liquids and to ensure the quantity of liquid satisfies the acceptance criteria.</p> <p>The waste shall contain as little residual liquid as is reasonably achievable by pouring, pumping, and/or aspirating.</p>
Sealed containers	<p>No sealed containers greater than 4 liters except for waste material type II.2 packaged in metal containers. Sealed containers greater than 4 liters, including rigid liners, shall be vented. Heat-sealed plastic bags must have at least one filter vent.</p> <p>Note – see TRAMPAC (section 4.0, Table 4-4) for waste material type II.2 definition</p>	<p>AK, radiography, visual examination, and/or packaging records.</p> <p>Taping a lid around the edges to secure it without venting the lid is considered a sealed container.</p> <p>Cross-taping across the lid, puncturing the lid, or crimping the container are acceptable methods for securing materials in internal containers.</p>

Table G-4. Chemical Properties.

Waste Attributes	Waste Acceptance Criteria	Compliance Methods
Pyrophoric materials	<ul style="list-style-type: none"> • < 1% radionuclide pyrophorics • No nonradionuclide pyrophorics 	AK documentation and records of procedures, processes, or evidence that shows no presence of pyrophorics or treatment to eliminate the characteristic
Hazardous waste	<ul style="list-style-type: none"> • Limited to EPA hazardous waste numbers listed in Table 3.5.2 of the WIPP WAC (Table G-7 below) and all Washington State waste codes 	<p>Approved Fluor Hanford Waste Profile Sheet</p> <p>AK documentation and records of procedures, processes, or evidence that shows hazardous waste codes as listed in Table G-7</p>
Chemical compatibility	No chemicals or materials that are incompatible	AK and/or records of sampling and analysis.
Explosives, corrosives, and compressed gases	No explosives, corrosives, or compressed gases	Radiography records, visual examination records, or AK documentation, and site policies/procedures prohibiting these items
Polychlorinated biphenyl concentration	< 50 ppm	AK and/or records of sampling and analysis

Table G-5. Data Package Contents.

Waste Attributes	Waste Acceptance Criteria	Compliance Methods
Shipping data	<u>Hazardous waste shipments:</u> <ul style="list-style-type: none">• Uniform Hazardous Waste Manifest (UHW) or bill of lading• Land Disposal Restriction (LDR) notification	UHW and LDR notification generated

Table G-6. WIPP-Acceptable RCRA Hazardous Waste Codes.

D004	D019	D034	F002
D005	D021	D035	F003
D006	D022	D036	F004
D007	D026	D037	F005
D008	D027	D038	F006
D009	D028	D039	F007
D010	D029	D040	F009
D011	D030	D043	P015
D018	D032	F001	----